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Electrical World

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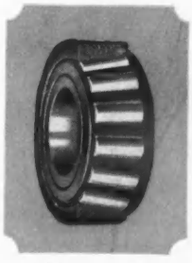
Anti-Friction under Thrust



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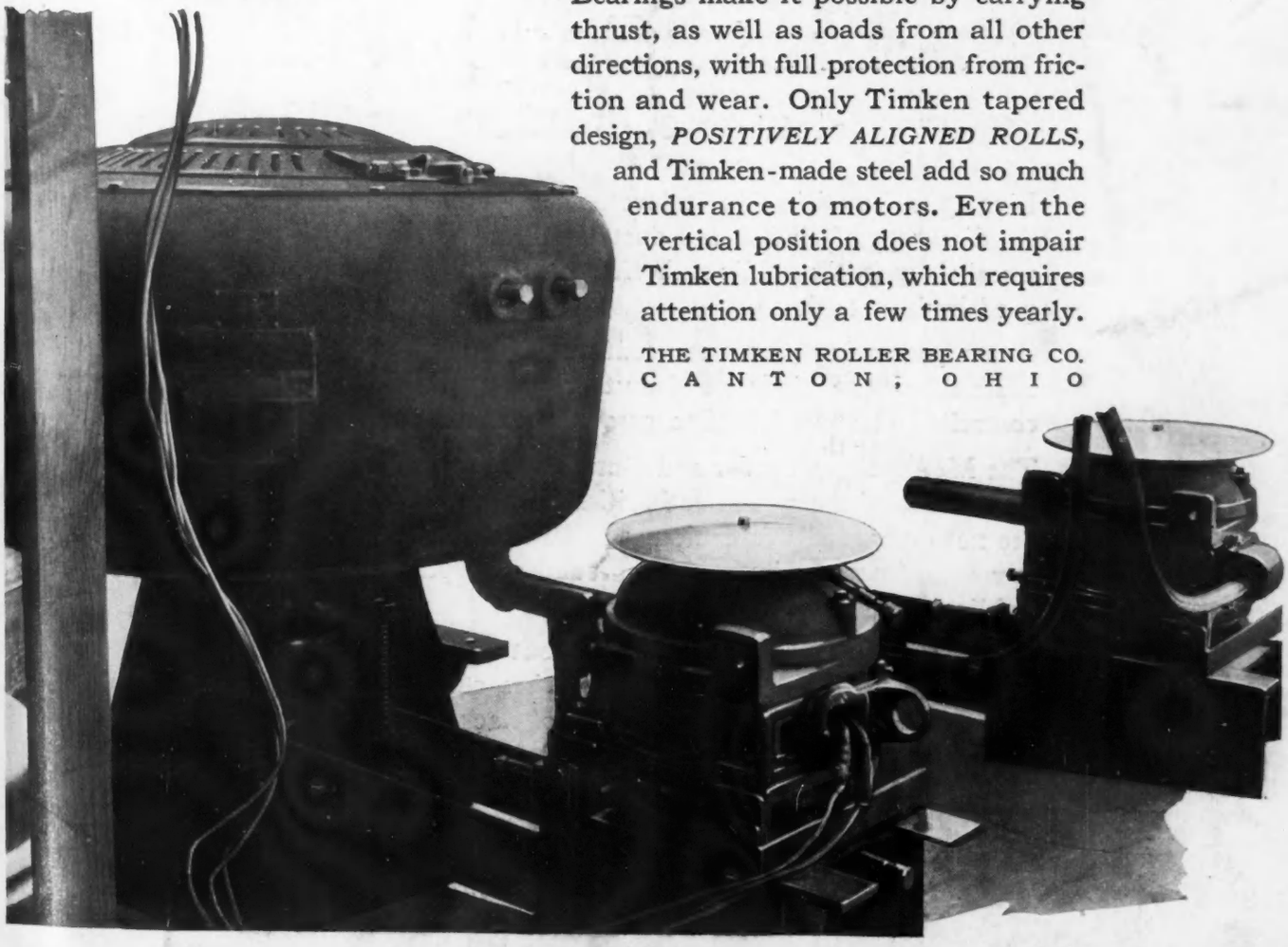

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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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CONTENTS

Editorials 1001

Frontispiece 1004

Engineering Versus Banker Efficiency in Hydro Developments 1005

Two fundamental requirements that are necessary to the success of any enterprise for the development of hydro-electric power are cited by the author.

Rate for Stimulating Rural Business 1008

Obsolete Street Lighting Scrapped 1009

Calculation of Wire and Conduit Sizes 1012

BY MAX KUSHLAN.

A series of curves based on fundamental formulas which offers a short solution for checking feeder design or making preliminary estimates.

A Direct-Acting Automatic Regulator 1015

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Details of its design and operation. It can be adapted to voltage, power and speed regulation, automatic synchronizing and limitation of short-circuit current.

Letters from Our Readers 1018

Central Station and Industrial Practice 1019

Commercial Activities and Public Relations 1023

Digest of Electrical Literature 1026

New Books 1028

News of the Industry 1029

Men of the Industry 1036

Court Decisions, Commission Rulings 1038

Financial and Corporate 1039

Manufacturing and Markets 1043

New Equipment Available 1047

Construction News 1048

Electrical Patents 1050

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"Real Editors
Are Not Pencil Pushers"

NOT a few people still appear to think that the principal task of ELECTRICAL WORLD editors is to report meetings and prepare "write-ups" of industry plants and activities. These staff members are pretty apt to be around at all important gatherings which they can plan to attend, but only a part of their work lies in "covering" events and developments. "Write-ups" have little or no place in the pages of a modern high-grade engineering and business journal, and such reporting as the staff performs is a winnowing-out process of the stiffest requirements.

As an editor lives among his industry people, his tasks tend to broaden into many activities indirectly connected with copy production, very much in proportion to the growth of confidence and business friendship between himself and his "constituents." Here are a few typical entries from an editorial diary: "Conferred with an executive relative to the organization of a new commercial department in a syndicate"; "Discussed continuity of sales service in a property about to be taken over by a new group of bankers"; "Helped fit a sales engineer into a new job"; "Advised a department head upon rate announcement policies"; "Conferred with a commission chairman upon a proposed merger plan"; "Supplied an executive with emergency statistics"; "Discussed prime-mover evolution with a staff engineer looking for inside experience with certain new types"; "Advised employees regarding utility investments and borrowing money on securities."

SUCH work as this gives an editor opportunities for service in unobtrusive ways that build up the usefulness of the ELECTRICAL WORLD and enhance the friendship of readers and industry personnel for the paper and its staff. It is collateral service, to be sure, but it supplements the direct service of ELECTRICAL WORLD pages, which in the long run are kept closer to the industry because of it.

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Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, November 13, 1926* — NUMBER 20

Laurels Are Gratifying, but Not to Rest Upon

SECRETARY HOOVER in his annual report pays a glowing tribute to the electrical industry, asserting that further improvement in the material condition of the people of the United States can come only through better utilization of industrial resources and effort. The Secretary divides high praise between railroad management and the entire electrical industry for multiplying the average man's buying power. Merited and appreciated as is this tribute, the industry well knows that it can do a much better job. So far it has taken the cream and the top milk, but there is great nourishment still in the bulk that remains. Moreover, while the industry stands in the front rank so far as efficient production is concerned, it has still some distance to travel before it attains commercial perfection. True, the ultimate consumer purchases his energy at a remarkably low price and the coal miner looks askance at the constantly diminishing quantity of coal consumed in producing a kilowatt-hour of electricity. Such things indicate efficiency, but so long as there are houses yet unwired and steam-electric generating stations employing more than one and a half pounds of good coal per unit of electricity there is plenty of room for improvement.

Praise from one so high in authority as Herbert Hoover may be music to the ears of the electrical industry; but the danger of self-satisfaction and smug complacency, with the attendant worship of the God of Things as They Are, is too obvious to be ignored. The industry might well say to Herbert Hoover: "Mr. Secretary, what you report is all very true. We have given a good account of our stewardship, but, while we are proud of the record and prouder still of your recognition of our work, we feel certain that left alone and unhampered we can do very much better." To aim ultimately at anything less than economic perfection would do the industry an injustice, and Hoover's praise should encourage and spur the electrical industry on to reach that goal.

Simplifying the Capital Maze

THE process of simplifying the capital structures of some of the large utility holding companies is proceeding rapidly. Yet there are still too many examples of structures so hopelessly complicated that the public is bewildered. The development of many of these parent companies into grotesquely complex relationships is an old story. It has become apparent to those who have given the matter special study, however, that scarcely any have been deliberately fashioned on this crazy-quilt pattern. Their development was along lines of least resistance. They were not contrived to deceive the investor, but are a natural result of the equally bewildering diversity of state laws and of other factors which compelled abnormal growth. A fact frequently overlooked might be added—that much of the expansion of the light and power industry would have been impossible without them.

But this is no excuse for the failure on the part of certain holding companies to rectify the situation by a program of simplification. Those who refuse to follow such a policy are bringing criticism and condemnation upon the entire industry, are promoting the cry for federal control and are alienating public good will. They are disregarding the demand of the investment banking fraternity, and the preponderating sentiment in the industry itself, for a housecleaning in this regard. The favorable side of the picture is the degree of simplification already achieved by certain companies. Examples are the Standard Gas & Electric, the American Light & Traction, the General Gas & Electric and the Penn-Ohio Edison. Outlines of what is being accomplished in this direction will be found from time to time in our financial department.

A New Spirit in the Commercial Section

THERE is a new spirit of confidence and purpose in the Commercial Section of the National Electric Light Association. It was distinctly evidenced last week in the group meetings of all the section committees at Chicago. For central-station sales managers have been suffering a little in recent years from the so-called inferiority complex. They admit it. They have been worrying about their inability to secure the support of the executives in their merchandising and load-building plans because the executives nave been so closely absorbed in finance engineering and operating. But last summer at Atlantic City the executives sprang a surprise. They accepted the commercial men's outspoken declaration of principles and by the most sweeping of indorsements called for the immediate development of the market on a scale more vast than the dreams of the most eager-hearted salesman.

When the Commercial Section committees met in September to organize, it was for stocktaking, and there was an atmosphere of hesitation apparent until the very frank progressive program for the year's work was announced. These men—and more—returned last week with confidence to discuss and make definite the plans for each committee's work. Six clear-cut objectives have been set up as the goal: (1) To establish at N.E.L.A. headquarters a national sales executive for the power industry to make possible certainty of policy and purpose in future; (2) to employ this man immediately in developing comparable market statistics for the central-station sales manager that will provide practical standards by which the commercial proficiency of any company may be measured; (3) to study the possibility of recreating rate schedules so that they may be promotional as well as protective in their influence; (4) to send

out in definite form for general guidance the principles of sales organization and management embracing personnel, compensation, sales policies and relations with the local trade; (5) to stop the wasteful practice of issuing voluminous reports at convention time—all in competition with one another—and substitute more interim reports and active co-operation with the electrical press to bring about prompter publication of experience and information that the committees wish to disseminate; (6) to develop a closer working relationship between the national and geographic section committees that the product of association work may be more effectively applied.

Chairman Davidson, Vice-chairman T. O. Kennedy, S. D. Heed, E. W. Lloyd, T. F. Kennedy, A. K. Baylor and other leaders in this revitalizing of the Commercial Section deserve the congratulations and the hearty support of all electrical men. They are looking well ahead and laying plans that are as important as anything that has happened in the power industry for many years.

Synchronizing at the Load

A UTILITY system can be visualized in which all generating units supply a load network over individual feeders and operate in parallel only at the load. In some transmission systems a generator, a transformer bank and a transmission line operate as a single unit and are connected to other units only at substations. But the idea of synchronizing only at the load has not been carried out completely on any large system, and it is not possible to decide the merits of such a scheme in the light of the study and experiences yet available. However, the idea merits consideration by the electrical industry.

With such a system there would be no necessity for busbars and complicated transfer arrangements in power stations; building space would be a minimum and operating convenience a maximum. Each generator and transformer bank would be a unit with several comparatively small-capacity low-tension feeders connected to the load network at several widely separated points, and this would make it possible to expand generating units without encountering limitations in the capacity of switches and cables. Each transformer bank with its outgoing feeders could be considered the only substation necessary, and a standard and very simple switching and protective scheme could be used for all feeders. Each feeder would have one switch and a voltage regulator to care for synchronizing with the network and for load division. If necessary, a manhole network switch could be connected at the network, or possibly power arcs could be relied upon to burn all faults clear at the network.

On the other hand, the development of such a system on an economic basis calls for high load density and a good load factor in order to utilize the investment in generating equipment and in the network installation. Each generating unit would be difficult to adjust to economical load conditions as compared with the situation when paralleling in generating stations is practiced. It remains also to be seen whether either an overhead or an underground network can operate with the service continuity required in the future. A low-voltage alternating-current network, similar to the direct-current networks now used, has definite limitations when applied to a large area, and the use of higher voltages introduces additional service hazards.

All the favorable and unfavorable elements in the proposal to synchronize at the load should be studied in the light of industry developments ten to twenty years from now. It would be false economics to adopt instantly and extensively any such radical change in existing layouts. Engineers are studying this proposal seriously and should arrive at conclusions of great value to the industry. New ideas are valuable if they serve only to bring about a check on existing practices.

Balanced Sales Organization Needed

CENTRAL-STATION companies, as shown in the electric refrigeration survey published in the ELECTRICAL WORLD for Oct. 30, have sold 31.9 per cent of the domestic electric refrigerators sold by all classes of dealers this year. As pointed out in the survey, that the power-company commercial departments in their first year of real activity in this field were able to make virtually one-third of the total sales speaks very well for the capabilities of their sales organization. It shows what these departments can do when their efforts are focused upon a definite objective. It has also brought out the fact that on the whole the central-station sales organization is decidedly undermanned.

A study of central-station refrigeration sales operations and their relation to other commercial activities reveals that in many companies sales of other electrical appliances dropped off sharply while refrigerator sales forged ahead. Some companies used their general sales forces and much of their advertising appropriations purposely to concentrate upon electric refrigeration. In some others it was not the intention to follow such a program, but their sales departments seemed naturally to fall into such a plan, and the result was similar. Now it has been said, and not without some reason, that central-station selling has got into the habit of doing one thing at a time either by means of the time-honored campaign method of selling or else by the industry's undertaking the development of a certain class of business on a national basis. Because of the limited man power in sales personnel up to the present time this has been the most practical and effective way of producing substantial results in certain selling programs. The experience in electric refrigeration this year indicates a very necessary step in building a substantial and well-rounded commercial organization.

It is almost unanimously agreed that the sale of electric refrigeration requires a special department or division for its proper development, and this must be put on a twelve-month basis. Industrial power sales have been conducted in this way for a number of years, and a good many companies have wisely divided their sales departments so that each class of business will receive continuous and adequate attention. But when in the development of one class of business, as in the case of electric refrigeration, it becomes necessary to deplete the personnel handling other classes, all-around development is retarded. True, it is possible to have too many irons in the fire at one time. On the other hand, if there be but one iron to be put in the fire, considerable time may be lost waiting for it to get hot. It is not

meant that any class of business has received too much attention—far from it. But surely industrial power, heating, commercial cooking, residential and commercial lighting, refrigeration, electric ranges and appliance merchandising all merit development, and it would seem that a logical sales plan should provide for continuous effort on each without sacrificing one for another.

The Opportunity at Hartford

PRELIMINARY announcements of the program of the second New England Conference, to be held at Hartford on Nov. 18-19, indicate that power-company regulation will occupy a prominent place in the proceedings. It is to be hoped that the proposed plan of the New England Council for regulation by joint commissions of interstate utility activities in the power transmission field will be set forth on this occasion in a way to command the attention of the country and to give the coup de grace to any agitation for federal investigation or regulation which may be in evidence at that time. Until joint commission regulation has been tried and proved a hopeless failure let no man put these state regulative bodies asunder!

If Professor Ripley continues his inquiries and studies in the field of utility finance and regulation, it is earnestly to be desired that this proposal of the diversified but harmonious business, governmental and utility interests of the Northeast will command his support in place of the objectionable policy of "Let Washington do it." The New England Council has achieved much in its first year of life, and the Hartford meeting should not be allowed to pass without driving home to every thoughtful citizen within reach of its deliberations by print, wire and air the importance of exhausting the resources of state regulation before fleeing to the national government in dealing with regional utility problems.

A New Solid-Junction Rectifier

STEADY progress in the development and improvement of electrical apparatus is well illustrated in the case of rectifying devices. Beginning with the alternating-current-direct-current motor-generator set, we have seen the appearance of the rotary converter, the synchronous commutator, the mercury-arc rectifier, the kenotron and other forms of tube rectifiers. These successive types of equipment have shown increasing simplicity of principle and operation, but all of them are apparently surpassed by a rectifier of which preliminary announcements have recently been made and which it is reported will soon be described in detail before the American Institute of Electrical Engineers. The discoverer of the principle is Dr. L. O. Grondahl, who now outlines a theory of its operation in a recent copy of *Science*. The rectifier unit consists of a disk of copper having a coating of oxide formed on its surface and another metallic disk forming the opposite electrode. It is found that under suitable conditions current flows more readily from the oxide to the copper than in the reverse direction.

The phenomenon is very much like that observed in a high-vacuum electronic discharge tube, in which electrons flow more readily from the hot cathode to the anode than in the reverse direction. There is the interesting difference, however, that in the case of the new rectifier the direction of the electron flow is opposite to that indicated by the theory underlying the electron tube. Explanations of contact rectification that appear most prominently in the literature, as, for example, electrolysis and thermo-electricity, are shown by Dr. Grondahl to be untenable for the new electronic solid-junction rectifier. The seat of rectification is apparently restricted to the layer near the junction between the copper and the compound formed on it. If the electron affinities of copper and copper oxide are nearly the same and the two materials are in such relationship as really to constitute a single body, a condition is brought about in which only a small amount of energy is necessary to enable an electron to escape from one substance to another. If one thinks of copper as having a great number of free electrons, there may exist an enormous emission of electrons from copper to oxide.

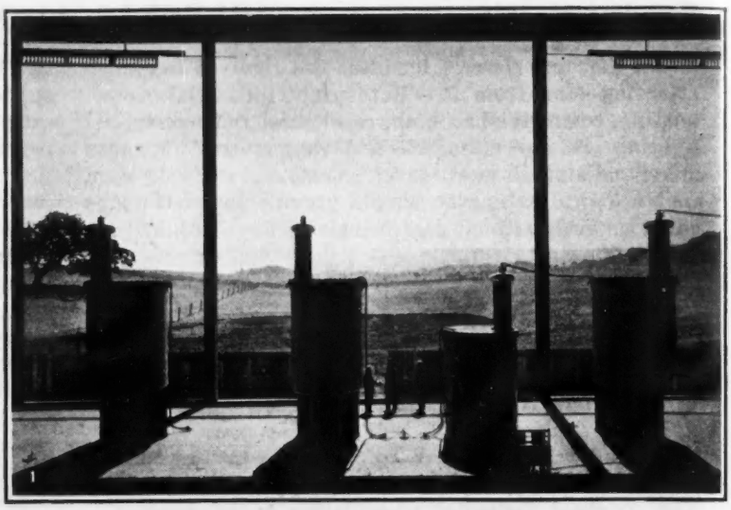
The unit about to be introduced on the market consists of several copper and oxide disks in parallel and faced with opposite electrode disks covering the oxide. Manufacture has been undertaken by a large and well-known company, and it is reported that already orders far surpass the factory capacity. Although the unit now offered is relatively small, it is so simple and rugged, and statements as to its life are so definite, that it is certain to be followed by other units of larger capacity.

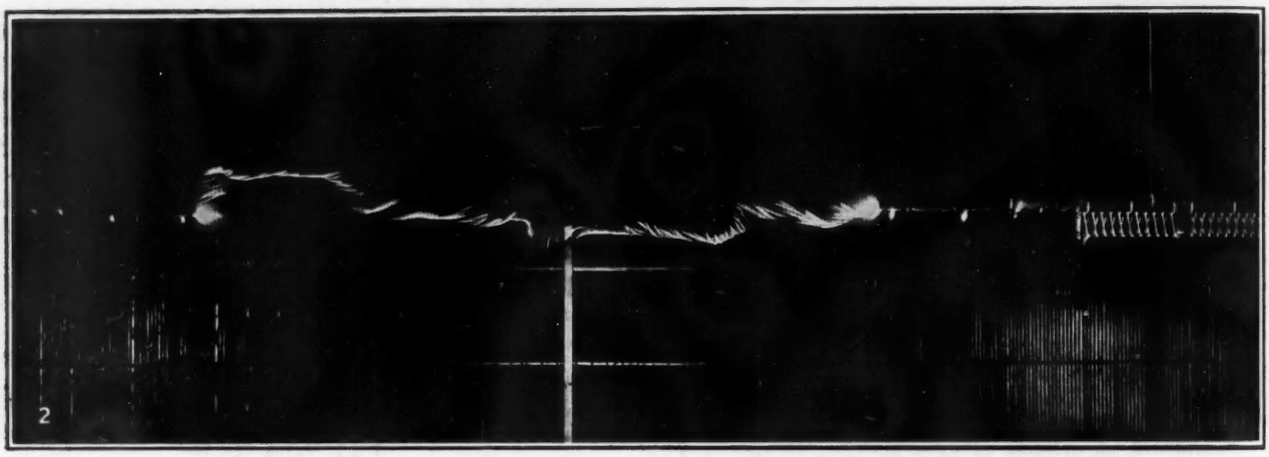
Why Not an Electrical Appliance Laboratory?

SEVERAL of the larger manufacturers of electrical appliances have exerted powerful influence to the end that the quality of their product shall be maintained at a high level, many of the smaller manufacturers have striven toward the same object, and in general this has been accomplished. Recently, however, less scrupulous manufacturers have entered the field with cheap and poorly constructed appliances. These lead to numerous service calls and frequently are the cause of great dissatisfaction on the part of the user. It should be the aim of the light and power company to encourage the better grade of appliances as against those which are poorly constructed and are offered in competition at low prices.

In this connection many central-station companies have adopted the practice of testing out appliances and approving them before they are placed in the display rooms and offered to the public. *Good Housekeeping* has established such a service for the benefit of its readers, and the label of that periodical has become familiar. Why should not electrical inspection and approval be made by a national laboratory supported by and carrying the name of the National Electric Light Association? Such a laboratory should be productive of great economies in carrying out inspection and approval and would do a great deal to encourage the better construction of appliances, because the weight of central-station prestige back of the approvals of this laboratory would be a forceful incentive to manufacturers to improve quality in cases where incentive is necessary.

Stanford's 2,000,000-Volt Research Laboratory



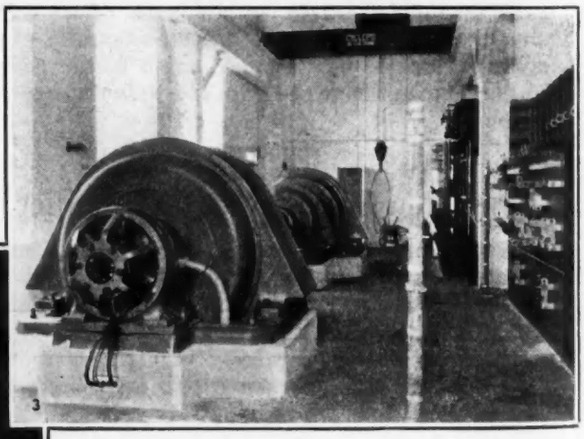


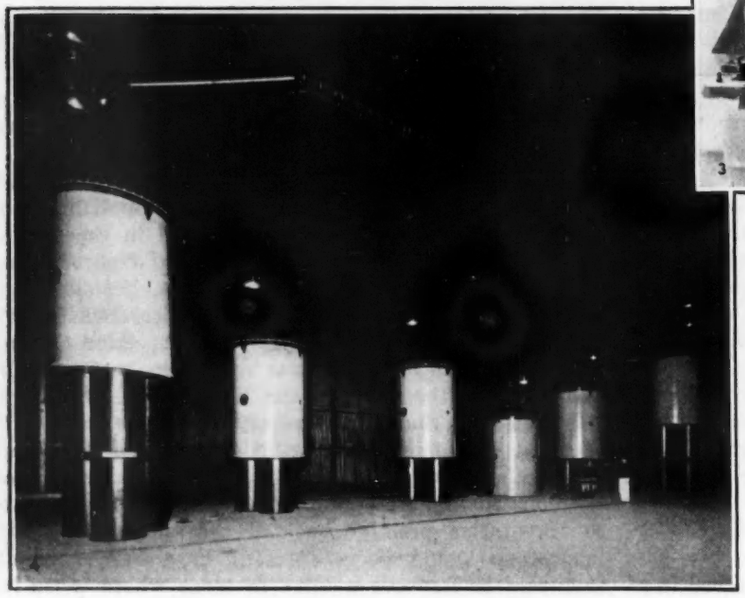
1. Four of the six 350,000-volt transformers. Five are mounted on insulating pedestals to permit of chain connection for higher voltages. Two of the transformers, not shown, but situated at each end of the transformers visible, are mounted on still higher pedestals than those shown. Silhouetted against the sky are the needle gaps. A control board is visible in the right foreground. The 40-ft. door opening shown provides for the high-tension leads to the experimental transmission line.

2. Two million volts bridging a 20-ft. gap between needle points.

3. Sine wave generators and control boards in building adjacent to laboratory, which is a corrugated sheet-metal structure.

4. Two heights of insulating pedestals used for transformers.





TWO million one hundred thousand volts at 60 cycles, single-phase, or one million volts at 60 cycles, three-phase, is now available in the new Ryan high-voltage laboratory at Leland Stanford University for the further conduct of high-voltage research under the direction of Dr. Harris J. Ryan. The laboratory was made possible through the donation of six 350,000-volt transformers by the General Electric Company and the aid of several California utilities.

Engineering Versus Banker Efficiency in Hydro Developments

Interconnected Plants Better Absorb Load Fluctuations and Afford More Permanent Service—Efficiency in Terms of the Engineer and the Banker Differs in Meaning

By ARNOLD PFAU

Consulting Engineer Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

THE success of any enterprise for the development of hydro-electric power is assured if it meets the following fundamental requirements:

1. Satisfactory service for the power consumer.
2. Satisfactory returns for the capital investor.

The first requirement is of a technical nature, involving engineering. The second concerns mostly the financial interests, but it also depends upon the successful performance of the first.

Satisfactory service depends upon the engineering quality of service and its permanency. Engineering quality of service is considered high when the electric energy is delivered to the consumer with the least possible fluctuation of voltage and number of cycles or revolutions per minute of revolving parts, even under a heavily fluctuating commercial load. The larger the power system (interconnection of individual plants) the smaller is the relative load variation and the easier it will be to keep speed (and voltage) within commercially satisfactory limits. For instance, in an interconnected system of 500,000 kw. a sudden load rejection of 5,000 kw. will constitute a relative load change of only 1 per cent, and this change is partly absorbed in the energy of the rotating masses of the interconnected system. Hence the acceleration of all revolving masses of the system in case of a 5,000-kw. load rejection or the deceleration in case of a 5,000-kw. load increase is so gradual that the control means or governors of the prime mover plants have ample time for a gradual and correct readjustment of the output in accordance with the new load demand. Not so with a small, isolated system of 10,000 kw., where a 5,000-kw. change constitutes a 50 per cent change in load, which imposes a severer duty upon the governing apparatus of the prime mover plant. At the same time the inherent or commercial flywheel effect of the 10,000-kw. system is much smaller than that of the 500,000-kw. system, which again indicates that a much severer speed change in the smaller system is inevitable.

The diagram, Fig. 1, illustrates the relation between speed decreases for fixed load increase of 7,500 hp. or fractions thereof, (1) of one unit operating on a water rheostat load, so that only the flywheel constant of the unit proper ($C = 5{,}000{,}000$; $WR^2 = 185{,}000$ ft.-lb. see data in example) is engaged; (2) of the same unit, operating, however, in parallel with (industrial) revolving masses, so that the flywheel constant is, say, 10,000,000 instead of 5,000,000, ($WR^2 = 185{,}000$ ft.-lb. turbine plus $WR^2 = 185{,}000$ ft.-lb. industrial part); (3) of two units in parallel with a system of 10,000,000 flywheel constant WR^2 total = 740,000 ft.-lb.; (4) of three units with $C = 10{,}000{,}000$, $WR^2 = 11{,}100{,}000$; (5) of four units with $C = 10{,}000{,}000$, $WR^2 = 14{,}800{,}000$; (6) of five units with $C = 10{,}000{,}000$, $WR^2 = 18{,}500{,}000$. In case 1 the load increase of 7,500 hp. constitutes 100 per cent of the total load. In case 2 the load increase of 7,500 hp. also constitutes 100 per cent of the total load; however, the ratio of $HP \div WR^2$ is $(7{,}500 \times 100) \div 370{,}000 = 2.025$ per cent, as against $(7{,}500 \times 100) \div 185{,}000 = 4.05$ per cent as before. Similarly in case 3 $WR^2 = (7{,}500 \times 100) \div 740{,}000 = 1.0125$ per cent; in case 4 $WR^2 = (7{,}500 \times 100) \div 11{,}100{,}000 = 0.676$ per cent; in case 5 $WR^2 = (7{,}500 \times 100) \div 14{,}800{,}000 = 0.50625$ per cent; in case 6 WR^2 $(7{,}500 \times 100) \div 18{,}500{,}000 = 0.405$ per cent.

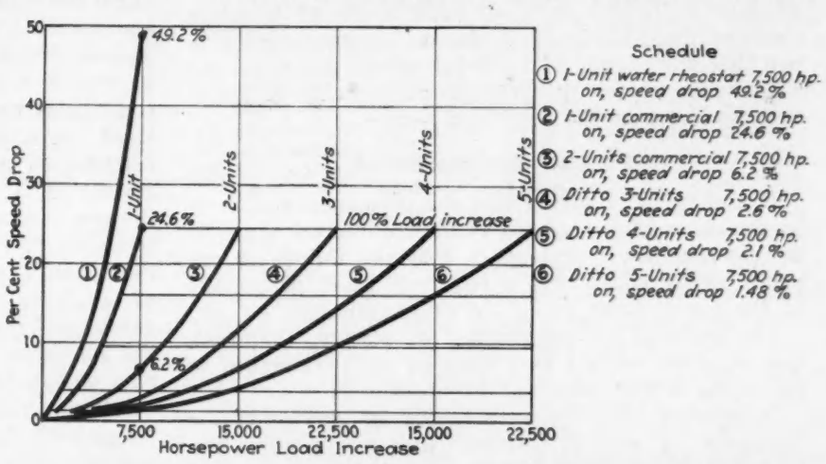


FIG. 1—SPEED EFFECT OF LOAD INCREASES ON HYDRO UNITS OPERATING ALONE AND IN COMBINATION WITH OTHER MACHINES TO GET A GREATER FLYWHEEL EFFECT

In the diagram the actual (horsepower) prime mover power is plotted as abscissas. The ordinates represent the per cent speed decreases as calculated. It can thus be seen that if five units participate in picking up the 7,500 hp. commercial load increase, the speed drop will be only about 3 per cent of the speed drop with one unit alone and under a water rheostat test where only its own flywheel effect participates.

Two conclusions can be drawn from an analysis of the effect of size of system on load changes:

1. Isolated power systems (for instance, prime mover plants of factories producing their own power) require a more liberal flywheel effect of rotating parts than prime mover plants operating in parallel with a large system and must be laid out so as to do justice to the relatively large sudden load variations. This requirement involves the proper selection not only of the prime mover equipment itself but also of those portions as penstock, forebay surge tank tunnel, etc., which carry the potential and kinetic energy to the prime mover.

2. The interconnection of prime mover plants serving a power system reduces the relative amount of sudden load change and thus relieves the controlling means of the prime mover of some of their duty so that the wear and tear is reduced. It is also reasonable to assume that the relative amount of commercial load change becomes less in a large system inasmuch as the individual load changes may not occur at exactly equal time intervals. Assume, for instance, that four of the 7,500-hp. units each serve its own system and suffer a periodical load change of 25 per cent. It is reasonable then to assume if these four units were paralleled to a system of 30,000 hp. that the four periodical load changes of 1,875 hp. each would not occur at exactly the same moment but would be somewhat apart, so that all four units will have an opportunity of taking a share of the 1,875-hp. load change. It may even happen that one change of 1,875 hp. offsets the other, etc. This again proves that the interconnection of power systems improves the quality of service.

PERMANENCY OF SERVICE

It goes without saying that the permanency of service is also greatly increased by interconnection of prime movers and power systems in that the failure of one prime mover constitutes a relatively small percentage of the total output going out of commission.

The question of permanency of service, therefore, can be given careful consideration with reference to the prime mover itself and its accessories.

Interlinked with the permanency of service is the "economy" of service, both of which vitally affect the "income" of the plant and thus reach into the second fundamental requirement—viz., the returns for the capital investor.

Permanency and economy of service again depend on two principal factors—viz., the proper operation of the equipment and the design, materials and workmanship of same. We all know that much depends upon the operation of a plant—not only on the care taken of it but also on the method of its operation. It would be folly, for instance, to operate a turbine full blast just to make a fine initial showing of kilowatt-hours produced, if by so doing the operating head were pulled down to a wastefully low point, necessitating a complete shutdown in a relatively short period or a waste of the available flow just for the purpose of keeping going. It would also be poor policy to let the equipment go to rack and ruin by failing to examine the unit from time to time, when with a relatively small expense and interruption in service it could be brought back to its former economical performance and be prevented from serious deterioration and consequent depreciation. Here again the benefits of interconnection are evident, in that such a unit can be taken out of commission without seriously affecting the service of the large system.

The question of economy of service, involving the design, material and workmanship of the unit proper, points toward that particular characteristic of the prime mover which is generally termed efficiency.

TOO LOOSE USE OF TERM "EFFICIENCY"

So far the term "efficiency" has not received adequate scrutiny. It has been left too much with the engineer and has not received its due share of attention from the banker. To avoid continuance of this condition it may be advisable to divide the old-established term "efficiency" into two terms—viz., "engineering" efficiency and "commercial" efficiency. The first can be to the engineer, the idealist, so to speak, and the second to the banker, who looks at the cold facts of the balance sheet of assets and liabilities, of income and expenses.

Engineering Efficiency.—The ratio of output to input, or kilowatt-hours measured during tests at the terminal of the unit to kilowatt-hours (potential and kinetic energy) delivered to the unit, all as accurately defined by testing codes and mutually accepted by the engineering science and profession.

Commercial Efficiency.—This newly introduced term may be defined also as a ratio of output to input, however, with a commercial definition of each factor—viz., output to be that amount of kilowatt-hours that produces the actual revenue of the plant; input to be that amount of kilowatt-hours that is available from the natural resource and that is required at times. It can be readily seen that the term "commercial efficiency" constitutes an essential item in the banker's balance sheet, as it directly affects the income and to some extent even the expenses, as will be shown later. The revenue of a plant as resulting from the operation of the prime mover comprises two items: (1) The positive item of income from the kilowatt-hours sold; (2) the negative item of expense involved during the period of shutdown. This may be caused by "power actually purchased" for making up loss of kilowatt-hours during the shutdown of the unit and by material and wages paid during the shutdown or repair of the unit.

"Engineering efficiency," so to speak, furnishes one "snapshot" analysis, or a group of such snapshot analyses, whereas "commercial efficiency" reaches over a period of time and takes in such defects of the prime mover as are not embraced even in a series of engineering efficiency tests.

Many an enterprise would be better off from the banker's viewpoint (and it is this that alone counts nowadays) if it were equipped with a simple piece of apparatus at moderate efficiency but "plugging along year in, year out" than a high-strung, high-efficiency design of unit, which may require special nursing and watching.

Due consideration of the term "commercial efficiency" may pave the way to a change in the attitude of the manufacturer of turbines as also of his customer purchasing them and engaging the capital of the investor, in that some of the importance so far attached to engineering efficiency is transferred to "commercial efficiency." Considering the accompanying examples, it can be seen that the engineer is still the banker's friend if he sacrifices as much as 3 per cent in engineering efficiency if by so doing he gains fully 8 per cent for the banker.

It seems that recent tendency has been too much along the line of engineering efficiency or engineering

Examples of Effect of System Sizes on Load Changes and Uses of the Term Efficiency

EFFECT OF SYSTEM SIZES ON LOAD CHANGES

Assume:

Five 7,500-hp. turbines.

n = 450 r.p.m.

WR^2 = 185,000 ft.^{2}-lb. = moment of inertia of revolving masses

T_x = 2 seconds (governor time for load change)

ϕ_x = per cent load change = 100% = 1

hp.$_x$ = hp. load change = ϕ_x hp. max. = 7,500

Flywheel Constant:

$$C = WR^2 n^2 \div hp.$$
$$= (185{,}000 \times 450^2) \div 7{,}500 = 5{,}000{,}000$$

Relative Speed Change:

$$S_x = (800{,}000 \text{ hp.}_x T_x) \div (n^2 WR^2)$$
$$= 800{,}000\ \phi_x T_x \div C$$
$$= 800{,}000 \times 2 \div 5{,}000{,}000 = 32 \text{ per cent}$$

This is based on the assumption that the turbine is set in an open flume so large that no drop in head occurs when the gates are thrown wide open by the governor in two seconds. Should the head drop, say, 25 per cent, then the momentary speed drop would be correspondingly greater.

For Example:

$$S_0 = S \div (1 - 0.25)^2 = 49.2 \text{ per cent}$$

or $(49.2 \times 100) \div 32 = 60$ per cent greater than in ideal setting

This serves as a picture indicating the importance of a well-designed setting of turbine and of the conduit portions, etc., of a hydro plant.

EXAMPLE OF USES OF TERM EFFICIENCY

1. e_θ = engineering efficiency = 90 per cent.

L_1 = period of interruption of service; for example, the unit considered fails to operate 500 hours out of 365 × 24 = 8,760, it being assumed that the input is available and the output can be marketed at all times. Material and wages paid during the 500 hours interruption represent a negative kilowatt-hour output value, L_2, say 2 per cent of the available input.

L_3 = the value of power purchased, and is equal to L_1.

Commercial Efficiency:

$$e_c = e_\theta \times \frac{L - L_1 - L_2 - L_3}{L} = e_\theta \left(1 - \frac{L_1}{L} - \frac{L_2}{L} - \frac{L_3}{L}\right)$$

$$\frac{L_1}{L} = \frac{L_3}{L} = \frac{500}{8{,}760} : \frac{L_2}{L} = 2 \text{ per cent; thus}$$

$$e_c = e_\theta\,(1 - 0.057 - 0.02 - 0.0057) = e_\theta \times 0.866$$

or 77.97 per cent.

In the banker's balance sheet our engineering "topnotcher" figures with about 78 per cent only, instead of 90 per cent. Let us now assume another type of unit:

2. e_θ = engineering efficiency = 87 per cent.

L_1 = 70 hours' interruption.

L_2 = 0.3 per cent, and $L_3 = L_1$.

Thus

$$e_\theta = e_\theta \left(1 - \frac{70 \times 2}{8{,}760} - 0.003\right) = e_\theta \times 0.981$$

or about 85.34 per cent.

In the banker's balance sheet our engineering "step-child" figures with only about 1½ per cent less than its ideal value, and more than 8 per cent better than the corresponding value of the "engineering topnotcher."

The two preceding examples are based on reasonable and absolutely practical conditions. Comparison of the "commercial" efficiencies as here refined sheds an entirely new light on the actual merits of a unit.

It may be appropriate to apply the two concrete examples, for instance, to a high-head (high-speed) Francis turbine and to a simple, moderate-speed impulse wheel.

"pride" and not enough along the line of commercial efficiency, or "permanency" in service. This attitude has also been too much nursed by the purchasers of hydraulic equipment and in many places more so by the engineers advising the purchaser. Lengthy and careful analyses are often made along the "engineering efficiency" item, but not enough along the item of "permanency" in service—that is, along the question of practical quality of design.

PRICE PREMIUM SUGGESTED FOR EFFICIENCY

Would it not be reasonable also to concede 1 or 2 per cent premium in the price of a unit if by so doing the commercial efficiency could be increased 1 or 2 per cent? Would the banker not be able to show an improvement in the transaction if the item of prime mover cost is increased about one-tenth to two-tenths of 1 per cent of the whole capital investment, if thereby the whole balance sheet by reason of greater "permanency" can be improved 1 to 2 per cent? Would he not at once point out that the one-tenth per cent overinvestment, bringing 1 per cent increased returns, constitutes a return of about 11 per cent on the amount overinvested in the prime mover?

Could a similar overinvestment not be justly approved for selecting the speed of a turbine so that it remains below that danger point of pitting of the runners, which often seriously reduces the "commercial" efficiency?

In the olden days technical enterprises depended on the engineer's ability. It was a question: "Can he do it or not?" Today the art of engineering has advanced to the point where nothing that we could reasonably ask cannot be done if there are enough funds available. The engineer has become the banker's tool or appliance, and all he is asked is: "What will it cost?" Then the question is again up to the banker: "Can you put it over?" If we engineers wish to retain a position that counts in the family of accomplishers, we must try to keep in synchronism with the banker by proving to him that he must still depend on us for many important items of his balance sheet.

Such factors as interest on outstanding indebtedness, depreciation and operating expenses, which affect a banker's or investor's measure of efficiency, and the effect of surplus power on capital return will be discussed in a later issue.

Natal to Have a 50,000-Kw. Station

WITHIN the next twelve months there will be completed alongside the railway between Congella and Umbilo, Natal, South Africa, says a local newspaper, a power station now under erection by the Electricity Supply Commission to house equipment rated at 50,000 kw. This station will serve two purposes—to supply power to the South African Railways Administration for trains between Durban and Maritzburg and energy to consumers within a radius of 42 miles of Durban.

The new station will be about 25 per cent more economical in fuel than the existing one. Two 12,000-kw., 3,000-r.p.m. Parsons turbines will drive three-phase, 50-cycle, 6,000-volt generators.

Rate for Stimulating Rural Business

Developed by the Wisconsin Power & Light Company to Protect Investment with Low Monthly Consumption and Still Encourage Large Consumption

MORE than 40,000 farms in the territory served by the Wisconsin Power & Light Company (see map page 820, April 17, 1926) have the option of purchasing electric service under a contract and rate schedule that was developed to meet the requirements for making rural service beneficial to both the utility and the farmer. During the past six months approximately 500 new rural customers have been connected. The average cost of the distribution system per customer is approximately $400, so that in building distribution lines to serve farmers approximately $200,000 has been spent in the last six months. There will, of course, be some slowing up of this rate of connection during the winter months, but the company expects the rate of connection to be doubled next summer. The new rural customers connected average about three to the mile. The energy consumption of the customers on the new rate is higher than under the old rate, but the company does not know just how much difference the new rate will make until after the first of the year.

The new rate received the approval of the Wisconsin Railroad commission June 21, 1926, but that approval does not order any of the former rates discontinued for a period of two years, hence the new rate does not supersede any of them during this period. Owing to the great multiplicity of rates now existing in the territory (as in many other places), the electric-service company sought, chiefly through public hearings and approval, to have the new rate schedule accepted to the exclusion of old rates, as a step toward simplicity and the best method so far found for bringing electric service to the farm under conditions favorable to the customer and the company.

The public hearing, which was called Jan. 22 for this purpose, brought forth some discussion, so the farmers were given an opportunity to consider it further and submit their comments and suggesions. After much discussion the farmers and the company reached an agreement and petitioned the commission to approve a rate with a rural charge of $3, $4 and $5 a month for 1½, 3, and 5-kva. transformer service instead of $5.50, $6 and $6.60 and an energy charge of 7 cents per kilowatt-hour for the first 50 kw.-hr. and 3 cents per kilowatt-hour for excess energy, instead of 5 cents per kilowatt-hour for the first 30 kw.-hr. and 3 cents for excess (allowing for prompt-payment discount). With a consumption of 50 kw.-hr. or more per month from a 3-kva. transformer, this accepted rate revision will result in a net loss of 60 cents per customer compared with the revenue obtainable under the proposal submitted at the first public hearing. On lower consumptions the loss would be greater, being $1.60 at 20 kw.-hr. per month, so the fixed charges on service inherent to rural supply would not be recovered.

There was also considerable discussion over what constitutes a rural customer eligible to this rate, the application of the contract when two or more services are taken from one transformer, and the ruling regarding the service charge for rural residences. The farmers favored elimination of the rules covering the two last subjects, so they are not included in the new contract.

In general, the new contract embodies these features: (1) Construction, operation, maintenance and financial ownership by the utility of the rural extension, including service and meters; (2) financing of the extension by the utility up to an average of $400 per customer; (3) payment by the customer for excess financing cost; (4) customer cannot resell or otherwise dispose of energy purchased except to a tenant, without the consent of the utility company; (5) a flat monthly service charge depending on the transformer capacity required as follows:

Transformer Capacity Required	Monthly Service Charge
Not more than 1½ kva	$3
Over 1½ kva. and not more than 3 kva	4
Over 3 kva. and not more than 5 kva	5
Over 5 kva. and not more than 7½ kva	6

*Where three or more customers are served from one transformer, the service charges may be reduced.

(6) An energy rate of 7½ cents per kilowatt-hour for the first 50 kw.-hr. per month and 3½ cents per kilowatt-hour for all in excess thereof, with a discount of ½ cent per kilowatt-hour for payment of bill within fourteen days; (7) customer agrees to make full use of electric service on farm; (8) permission of customers to erect distribution lines along highway adjacent to property and services on property; (9) cancellation of service charge for any month, but not exceeding three months, during which premises are not occupied, due to change in tenancy.

Accompanying the contract are some explanatory remarks or rules which clarify many points that have been the subject of debate heretofore. They cover: (1) Intent; (2) definition of rural customer; (3) definition of rural extension; (4) cost of extension; (5) analysis of extension; (6) payments by customers, (7) additional customers; (8) combined rural extension and transmission line; (9) customer's investment in equipment; (10) rate; (11) public buildings on rural extensions; (12) new customers on old extensions; (13) continuity of services; ((14) change in tenancy; (15) urban rules; (16) type of service; (17) extensions from high-voltage lines; (18) inspection of installation; (19) rates for villages excluded; (20) substitution of rates.

Rural Customer Defined.—For the purpose of these rules, a rural customer is defined as a purchaser of electric service (except customers of a class for which the company has a suitable urban rate filed with the Railroad Commission) who can be adequately served from one transformer of not more than 10-kva. capacity; and who uses the service in the conduct of one enterprise, occupation or institution, located outside the limits of a city or village or community with similar characteristics, at such distance that it cannot be adequately served from the secondary lines of the local distribution system.

A purchaser of electric service, for use at a rural residence which is located outside the limits of a city, village or community with similar characteristics, and which is in all respects a separate family establishment, and is not directly connected with the operation of a farm, is expressly exempted from this definition. Such service is hereby designated as rural residence service.

A farm is hereby defined as any area of land from which the occupant derives an appreciable part of his income.

Two or More Service Lines from Transformers.—The rates set forth above are based on one service line and one meter per rural customer.

If two or more rural customers are served from one transformer, each shall pay the same service charge as though served by a separate transformer.

Obsolete Street Lighting Scrapped

Indianapolis Relights Its Streets Throughout the City—All Fixtures Designed to Harmonize, Allow for Growth of the City and Accommodate New Developments in the Lighting Art

NIGHT VIEW OF ONE OF INDIANAPOLIS' RELIGHTED STREETS

SCRAPPING all of the obsolete street lighting in a city of 325,000 population and replacing it with the most modern installation that can be procured is a new procedure in the annals of street lighting. Yet this is what the city of Indianapolis has done recently, illustrating an appreciation of the value of street lighting that has never before been so forcibly and tangibly expressed. A complete change of the system was made despite the fact that the antedated system is only ten years old and constituted at its inception what was then considered the last word. This action is significant as indicating how any street-lighting system must be given periodic attention to keep up with developments and requirements. The Indianapolis street-lighting system, which is considered by some authorities one of the best, if not the best, in the United States, includes every street and not merely the downtown streets, main thoroughfares or residential portions, which separately may have been lighted just as well by some other cities. It has been designed and installed not only to meet present-day conditions but to accommodate itself to the growth of the city and advances in the art of lighting.

Of the various reasons why the Indianapolis street lighting was completely changed, the fact that growth of automobile traffic demanded better illumination was predominant. In addition, the development of artificial lighting since the last change has brought about a great increase in lamp efficiency and change in method of utilizing light. In the meantime the public has surrounded itself and become accustomed to higher intensities in homes, stores, offices and factories, so that the old street lighting appeared poor in contrast. The latter condition arose because the specific terms of the previous contract did not provide for making changes or improvements during its ten-year life. In drawing up the new specifications this privilege was carefully guarded and provisions were made so that the city can take advantage of any new developments for the next ten years. Both the previous and present contracts require that the Merchants Heat & Light Company furnish, install, maintain and operate the entire system on a 4,000 burning hour basis per year at a definite charge per unit. Provisions are also made for allowances or credits to the company or the city, as the case may be, for conditions that may arise and are not covered by definite specifications.

Prior to the last change a careful survey of the city's lighting requirements was made by dividing the streets into five main classes—primary business streets, secondary business streets, principal thoroughfares, secondary thoroughfares and residential streets. Future requirements were also taken into consideration based on recommendations by the City Planning Commission as to traffic conditions, business sections and arterial streets. Factors such as width and character of street, types of buildings, pedestrian and automotive traffic and further growth of the city were taken into consideration. The preliminary investigation also involved a tour of inspection of other cities, consultation with nationally known lighting authorities and further studies of lighting equipment. After all factors were considered, the city, through the Board of Public Works, decided upon incandescent lamps exclusively, General Electric fixtures, Westinghouse transformers and Union Metal Company pressed-steel standards. A definite plan of spacing was adopted so that as the city grows and higher intensities are required the system will be uniform and the moving of standards will be unnecessary. This spacing is 105 ft. or multiple thereof. In order to permit increases in intensities, the lamp sizes can be increased, additional columns added in the intermediate spaces or duplex tops provided. All of the

ornamental equipment, including posts, glassware, etc., are of the same design, differing only in height and size, to conform to the various illumination requirements. Thus the entire installation is unified and harmonious.

On the main business streets and on portions of streets to which it is desired to direct traffic, two 15,000-lumen Mazda C lamps per post are used, the posts being spaced opposite one another about 105 ft. apart along the streets. The lamp centers are approximately 20 ft. above the street and are fitted with No. 9 Novalux units and No. 118 medium alabaster rippled glass globes and canopies. Pressed steel standards are used here, as throughout the rest of the city, for all ornamental lighting.

On the secondary business streets and portions of the principal thoroughfares one 15,000-lumen Mazda C lamp per post is used with posts opposite one another

WHITE-WAY STANDARD AND ORNAMENTAL-UNIT LAMP CASING

on 105-ft. centers. A mounting height of 15 ft. is employed. The same lamp equipment is used as in the two-light standards in the main business district.

For arterial and other important thoroughfares, one 6,000-lumen Mazda C lamp per post is used, the posts being on opposite sides of the street in a staggered formation with one lamp every 110 to 125 ft. of street. The mounting height is 12 ft. The lamps are equipped with Form 8 Novalux units and 127 light alabaster rippled-glass globes, canopies and prismatic glass-dome refractors. The globes are the same in contour as those used in the downtown district, but are smaller size, so as to conform correctly to the smaller size lamp.

The secondary thoroughfares are illuminated by 4,000-lumen Mazda C lamps, provided with the same sort of equipment and spaced the same as on the primary thoroughfares.

Throughout the residential district the old flaming arc lamps have been replaced by 10,000 and 6,000-lumen Mazda C lamps equipped with Form 6 Novalux pendent units, using acorn-shape rippled-glass globes and dome refractors. Mast arms attached to wood poles are to be used in the outlying districts, extending 12 ft. into

TABLE I –LAMPS INSTALLED IN NEW STREET-LIGHTING SYSTEM INDIANAPOLIS, IND.

Quantity	Description of Unit	Lumens	Spacing	Height, Ft.
606	Duplex columns	2–15,000	105 ft. opposite	20
984	Single columns	15,000	105 ft. opposite	15
1,300	Single columns	6,000	110–125 ft. staggered	12
976	Single columns	4,000	110–125 ft. staggered	12
19	Single columns	2,500		10½
2,210	Overhead pendants	10,000	300 ft. one side	20
300	Overhead pendants	6,000	300 ft. one side	20
166	Overhead brackets	2,500	300 ft. one side	16
30	City-owned columns	2,500		12

the street at such an elevation that the lamps will be 22 ft. above the street at the intersections.

Underground circuits supply the ornamental equipment, single and duplex No. 8, 5,000-volt, lead-covered cable, placed in tile duct, being used in the main business district. On the thoroughfares No. 8 single-conductor, lead-covered, steel-armored, jute-protected cable is laid directly in the ground 18 in. below the surface. Where necessary to cross the roadway, the cable is placed in pipe conduit. All of the old circuits were in such condition as to be suitable for the new service.

Standard series circuits are employed to serve the lamps. Hand-controlled, constant-current transformers at the main substation supply the energy for the downtown and main thoroughfare lighting circuits. By means of relay switches these circuits also control through cascade relays the outdoor pole-type constant-current transformers that supply energy to the remainder of the system. Thus the entire installation is controlled from one point. The constant-current regulators are the Westinghouse two-coil type, being the same as used on the old system.

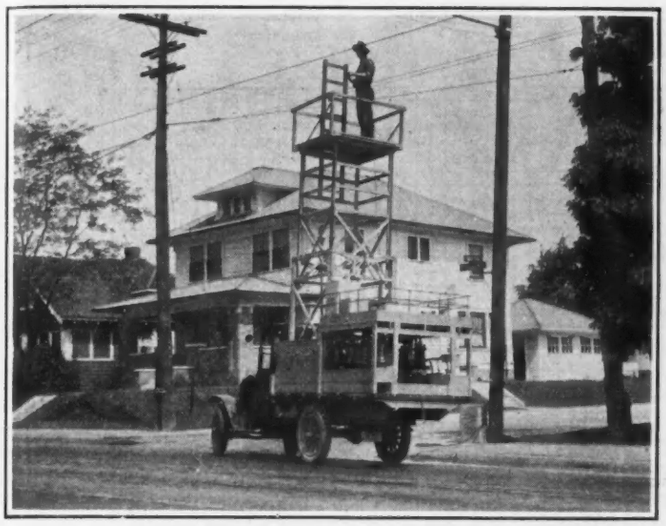
To assure safety and best operating conditions, all lamps are of the 15 or 20-amp. type equipped with individual transformers located in the base of the ornamental standards or in the hoods of the pendent units. For the ornamental standards these transformers are of the two-coil insulating type, and those in the pendent units are auto-transformers. Both are furnished by the Westinghouse company. With all lamps smaller than 15,000 lumens, transformer windings are arranged to supply lamps of the next larger size, so that if more light is desired the change to larger size lamps can be made at slight cost.

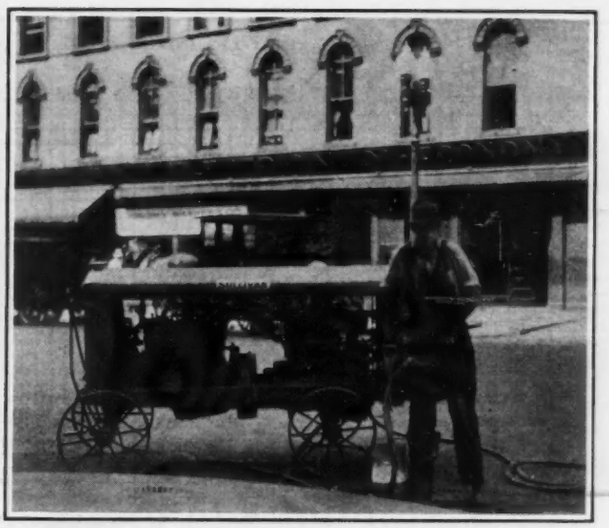
One feature of the metal standards is that they are designed so that the same bolt circle and base is used on all 12, 15 and 20-ft. columns. In addition, the standard is designed so that a single light 15-ft. unit can be converted into a duplex 20-ft. unit by simply adding a two-light section. Where lamp columns are mounted over basements and where sidewalks are sufficiently thick, anchor rods are fastened directly to the sidewalk by calking with lead-wool. Bolts so fastened

TABLE II—COST OF INTENSIVE LIGHTING WITH THE NEW SYSTEM*

Type	Lumen Rating	Basic Rate 4,000 Hour Schedule
2-light, 20-ft. ornamental column	15,000	$135.00
1-light, 15-ft. ornamental column	15,000	75.00
1-light, 12-ft. ornamental column	6,000	42.00
1-light, 12-ft. ornamental column	4,000	35.00
1-light, overhead pendants	6,000	34.50
1-light, overhead pendants	2,500	21.50
1-light, overhead pendants	1,000	37.50

* Various charges are made for maintenance, service and energy, depending upon the nature of the equipment. The foregoing prices were made possible only because of the fact that equipment already installed could be utilized to a great extent. There were used 606 duplex 20 ft., 984 single 15 ft., 1,300 single 6,000 lumens and 976 single 4,000 lumens.





TRUCK WITH EXTENSION LADDERS USED IN REHABILITATION AND PNEUMATIC PAVEMENT BREAKER THAT EXPEDITES TRENCHING FOR CABLE

will resist an extraction force of more than six tons, which was the limit of the testing device. To provide entrance of the cable to the base of the lamp, two holes were drilled through the sidewalk and curved at an angle of 30 deg. from the vertical, running to the pull box below the surface of the street.

On account of the added loads, much new underground work is being installed. Some of the labor-saving devices employed in this work are interesting. For example, a jig or form for holding the foundation bolts and providing a circular beveled finish to the top of the foundation was employed. To facilitate handling cable, a one-man operated cable car was designed so that the driver of the tractor can go to the storage yards and load up a five-ton reel of cable and return without assistance. For erecting massive 20-ft. duplex columns, a telescopic derrick, operated entirely from a truck winch, was used. Trench work was expedited by the use of air compressors and air tools, such as drills, jackhammers, concrete breakers and backfill tampers. In converting the mast arms with rope-lowering absolute cutout type suspensions to a permanent suspension type, trucks with hand-operated platforms were used to good advantage. Light trucks, equipped with safety stepladders, permanently mounted on the top of the truck but arranged for lowering in transit, enabled changing the overhead pendent lamps. Individual transformers with pigtail terminals and tinned wire joints with rubber tape insulation were used. Cable sheath as well as armor are bonded together at each lamp. Sewer tile elbows are inserted in the lamp foundation in alignment with existing curved duct. Where parkway cable was used, a tapering mandrel, similar to a ball bat, was employed in forming the concrete.

With the old street-lighting system, the total light output was about 44,000,000 lumens, of which approximately 8,500,000 was available on the street. With the new equipment, providing 70,000,000 lumens, 17,500,000 can be directed on the street by the superior light control, this giving 80 per cent more light at small increase in cost.

The ELECTRICAL WORLD is indebted to M. K. Foxworthy, manager Merchants Heat & Light Company, Indianapolis, and Ward Harrison, director of illuminating engineering, National Lamp Works, for the foregoing information.

FOUNDATION JIG IN PLACE AND FOUNDATION COMPLETED

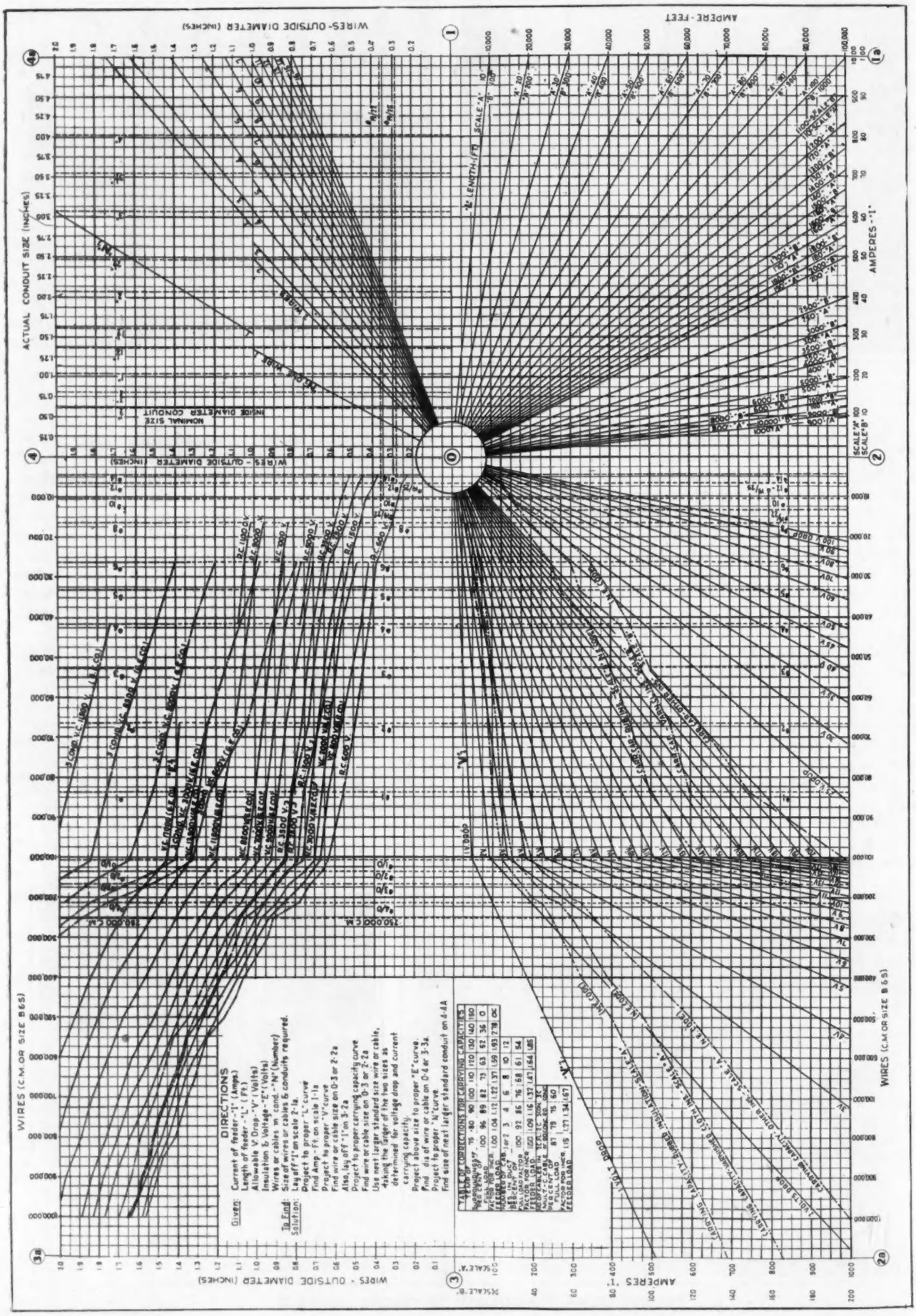

DIRECTIONS
Given
To Find
Solution
Current of feeder - "I" (Amps)
Length of feeder - "L" (Ft)
Allowable V. Drop - "V" (Volts)
Insulation & Voltage - "E" (Volts)
Wires or cables in cond. - "N" (Number)
Size of wires or cables & conduits required.
Lay off "I" on scale 2-1a.
Project to proper "L" curve
Find Amp - Ft on scale 1-1a
Project to proper "V" curve
Find wire or cable size on 0-3 or 2-2a
Also, lay off "I" on 3-2a
Project to proper carrying capacity curve
Find wire or cable size on 0-3 or 2-2a
Use next larger standard size wire or cable, taking the larger of the two sizes as determined for voltage drop and current carrying capacity.
Project above size to proper "E" curve.
Find dia of wire or cable on 0-4 or 3-3a.
Project to proper "N" curve.
Find size of next larger standard conduit on 4-4A
TABLE OF CORRECTIONS FOR CARRYING CAPACITIES
WIRES (C.M. OR SIZE B&S)
WIRES - OUTSIDE DIAMETER (INCHES)
ACTUAL CONDUIT SIZE (INCHES)
NOMINAL SIZE INSIDE DIAMETER CONDUIT
AMPERES - "I"
AMPERE - FEET
LENGTH - L/FT
SCALE "A"
SCALE "B"
CARRYING CAPACITY - DIRECT CURRENT - SCALE "A"
CARRYING CAPACITY - ALTERNATING CURRENT - SCALE "A"
VOLTS DROP
LINE LOSS
WIRES - OUTSIDE DIAMETER (INCHES)
AMPERES - "I"
WIRES (C.M. OR SIZE B&S)

FIG. 1—WIRE AND CONDUIT SIZES FOR POWER AND LIGHTING CIRCUITS

Calculation of Wire and Conduit Sizes

A Series of Curves Based on Fundamental Formulas Offers a Short Solution for Checking Feeder Design or Making Preliminary Estimates

By MAX KUSHLAN
Stone & Webster, Inc., Boston, Mass.

THE determination of correct wire and conduit sizes for transmission of electrical energy involves a number of computations based on certain fundamental formulas, tables or curves. Where special problems arise requiring fairly accurate solutions, computations are the only reliable means. But in work like checking designs of feeder lines or for preliminary estimates of material it is advantageous to use short graphical solutions, provided they are within the limits of required accuracy. The system of curves described has been compiled for such a purpose, and their limitations must be clearly understood before any attempt is made to use them. The curves are shown in Fig. 1.

The system of curves is made up of four distinct "quadrants" having a common central point *O*. The normal order of these quadrants is as follows: Quadrant No. 1 between lines *O*-1 and *O*-2; with current and length of feeder given, we can determine the product (ampere-feet). Quadrant No. 2 between lines *O*-2 and *O*-3; given ampere-feet and voltage drop, we can determine size of wire; also given current in wire, we can find size of wire. Quadrant No. 3 between lines *O*-3 and *O*-4; given size of wire and type of insulation, we can find outside diameter of the conductor. Quadrant No. 4 between lines *O*-4 and *O*-1; given outside diameter of each conductor and number of conductors in a conduit, we can find the proper size of conduit. Each of these four quadrants can be used independently, providing two of the three quantities are known and we have to find the third, but in most of the problems all the quadrants are used in their natural rotation from 1 to 4.

In the first quadrant the abscissa has two scales, A and B; scale A from 0 to 1,000 amp.; scale B from 0 to 100 amp. The curves in this section are a series of straight lines each having two different values of length in feet, length A to be used with ampere scale A and length B for ampere scale B. This section is simply a multiplication of the two factors, amperes I and feet L, and the product in ampere-feet is scaled along the ordinates 1-1a.

The second quadrant has a double system of curves, one for wire sizes as determined by allowable voltage drop, and the second for wire sizes as required for safe carrying capacity.

The voltage drop curves are based on the formula

$$A = 21.6IL \div e \qquad (1)$$

where A is area in circular mils.

I = Current in amperes in each wire.

L = Length of one wire in feet.

e = Allowable drop in volts.

This formula is accurate for direct-current circuits. For alternating-current circuits the voltage drop curves may be used for finding approximate wire sizes under certain conditions. The more exact method for alternating-current lines would be to use the Mershon diagram. In checking up actual voltage drops by the Mershon curves, the wire sizes as read off on the voltage drop curves will serve as the first trial in the "cut-and-try" method for computing line resistances and reactances.

In cases of alternating-current feeder design where values of line impedance drops are predetermined, such values may be substituted as the voltage drop curves in this graphical solution, provided the wire sizes read off from the curves are corrected for actual line characteristics.

Some of the impedance drop multipliers and correction factors for alternating-current lines to be applied to wires found by using the curves are given in Table I.

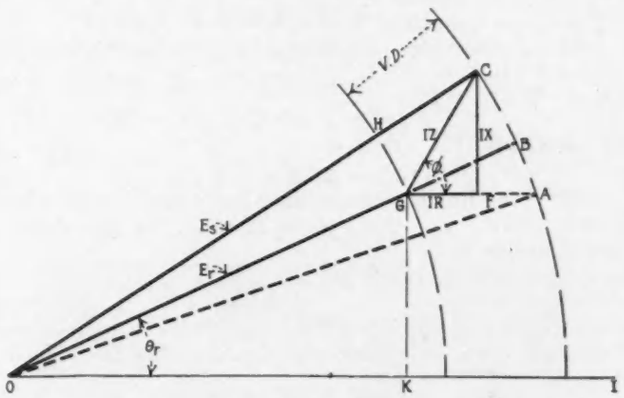


FIG. 2—SINGLE-PHASE VOLTAGE RELATIONS

Fig. 2 shows the phase relations of voltages in a single-phase feeder. Line *OI* is the assumed vector position of line current I lagging behind the receiving end voltage E_r by phase angle θ_r. The resistance drop of the load is represented by *OK* and reactance drop of load by line *KG*. Line resistance drop IR is indicated by *GF*, line reactance drop IX by *FC* and line impedance drop IZ by *GC*. The total line voltage E_s required at the sending end is indicated by line *OC*. Line voltage drop to neutral $= E_s - E_r =$ line *CH*. Assuming this voltage drop, also power factor and voltage at receiving end to be fixed, the power factor at the sending end will depend upon the ratio $X : R = \tan \phi$, or ratio of line reactance to line resistance. It will be noted that with a negligible reactance the line impedance drop $IZ = IR$ (line *GA*) and voltage at sending end will be as indicated by line *OA*. With the line phase angle ϕ equal to the power factor angle θ_r, line impedance will be in a straight line with E_r as shown by line *GB*, and in this case the line impedance drop is equal to the voltage drop.

For alternating-current feeders, given line impedance drop *IZ* (volts), also amp.-ft.; find approximate wire size by using *IZ* value in voltage drop curves (second quadrant of the graph).

Find *X* : *R* ratio in any reliable table using the wire size found by the curves. Apply the proper correction factor.

The multipliers and correction factors in Table I are derived in the following manner:

TABLE I—IMPEDANCE DROP FACTORS

Ratio of Reactance to Resistance $\frac{X}{R}$	Multiplier for Three-Phase Circuits $K=10.8\sqrt{3}\times\frac{1}{\sqrt{1+\left(\frac{X}{R}\right)^2}}$	Correction Factor for Three-Phase $F=\frac{K}{21.6}$	Multiplier for Single-Phase Circuits $N=10.8\times 2\times\frac{1}{\sqrt{1+\left(\frac{X}{R}\right)^2}}$	Correction Factor for One-Phase $H=\frac{N}{21.6}$
3.00	59.2	2.74	68.4	3.16
2.50	50.0	2.31	57.7	2.67
2.00	41.9	1.94	48.5	2.24
1.50	33.7	1.56	39.0	1.80
1.25	30.0	1.39	34.6	1.60
1.00	26.4	1.22	30.4	1.41
0.75	23.4	1.07	27.0	1.25
0.50	21.0	0.97	24.2	1.12
0.40	20.2	0.93	23.3	1.08
0.30	19.5	0.90	22.5	1.04
0.20	19.1	0.88	22.0	1.02
0.10	18.8	0.87	21.7	1.00
0.00	18.7	0.86	21.6	1.00

We have the fundamental relation

$$R = (10.8 \div A)\ L \qquad (2)$$

where R is resistance of one conductor in line (ohms).

A = Cross-sectional area of conductor (circ. mils).

L = Length of feeder, one way (feet).

10.8 = Resistance of one mil foot of copper wire.

$$IR = I\ (10.8 \div A)\ L \qquad (3)$$

$$IX = IR\ (X \div R) = I\ (10.8 \div A)\ L \times (X \div R) \qquad (4)$$

$$IZ = \sqrt{(IR)^2 + (IX)^2} = I\ (10.8 \div A)\ L\sqrt{1 + (X \div R)^2} \qquad (5)$$

This is the line impedance drop to neutral in a single-phase circuit. For three-phase circuits, the impedance drop between lines is:

$$10.8 \times \sqrt{3} \times \sqrt{1 + (X \div R)^2} \times IL \div A = K\ (IL \div A) \qquad (6)$$

where K is the multiplier for three-phase circuits (see Table I). For single-phase circuits the impedance drop is:

$$10.8 \times 2\sqrt{1 + (X \div R)^2} \times (IL \div A) = N\ (IL \div A) \qquad (7)$$

Since the curves are plotted on the basis of a multiplier of 21.6, the correction factors are:

For three-phase circuits $F = K \div 21.6$ (8)

For single-phase circuits $H = N \div 21.6$ (9)

If reference is made again to the *V* drop curves in the second quadrant it will be noted that the wire size scale at the 100,000-circ.mil line is changed in order to make the curves for the smaller-sized wires more legible and still retain the wide range from No. 14 wire to 1,000,000-circ.mil cable.

The abscissas for the *V* curves are along the 1-1*a* line in ampere-feet, the ordinates are on 2-2*a* line, also on lines *O*-3 and 4-3*a* in circular mils with special lines for B. & S. wire sizes.

By projecting the proper ampere-foot value until it crosses the proper *V* curve we find the nearest larger wire size required.

The second series of curves in the second quadrant consists of six curves for carrying capacity, three plotted against the A scale of amperes along the line 3-2*a* and three curves corresponding to the B scale on the same line. Scale A is for large feeders carrying a maximum current of 1,000 amp., and scale B is for smaller feeders for a maximum load of 200 amp. These curves are based on the tables published by the National Electrical Code, 1923 edition, for rubber, varnished cloth and other insulations.

By projecting the given load in amperes from line 3-2*a* until it intersects the proper carrying capacity curve the nearest larger wire on scale 2-2*a* can be read. These wire sizes are correct, assuming a temperature of surroundings to be 75 deg. F., not more than one or two cables in a duct, and one conductor in each cable. For heating conditions greater than those assumed as normal the maximum current that can safely be carried by the conductor is decreased as shown on the table given under *O*-3 line in the second quadrant. These values were determined experimentally by the Simplex Wire & Cable Company in 1918 in the form of percentages of full load for various conditions of temperatures and numbers of surrounding conductors in the duct or in the same cable. The correction factors to be applied to the wire sizes as found from the curves are the reciprocals of these percentages; thus, for a temperature of surroundings of 110 deg. F., the percentage of full load is 73, and the correction will be circular mils (from curves) $\times$ 100 $\div$ 73 = centimeters $\times$ 1.37 (10)

The wire found to be the larger of the two as determined by voltage drop and carrying capacity is to be used in the circuit.

The third quadrant consists of a series of curves plotted for various types of insulation against wire sizes on line 4-3*a* as abscissa and outside diameter of conductor (in inches) as ordinates on lines 3-3*a* and *O*-4. By projecting a given wire size until it intersects with the proper voltage insulation curve, we can read the outside diameter. The rubber-covered insulation curves are based on standard tables for hevea or para rubber. The single and three-conductor varnished cloth insulations are based on General Electric Bulletin 49,307.

For special insulations such as Kerite we must use the manufacturer's tables instead of the curves, or apply a correction factor to the diameters found from the curves.

The fourth quadrant has a number of curves giving the minimum sizes of standard conduits for any number of wires in a conduit from one to sixteen inclusive. These curves were plotted from the formula:

$$D = d \times M \qquad (11)$$

where D is the diameter of the conduit required (inches).

d = Diameter of wire or cable in inches over the insulation and protective coating.

M is a multiplier depending on number of wires or cables in a conduit.

is based on geometrical computations and on full-size layouts of wires in a conduit. Table II gives the values used for M for one to sixteen wires inclusive.

TABLE II—MULTIPLIERS FOR CONDUIT SIZES

No. of Wires n	1	2	3	4	5	6	7	8
$M=D/d$.....	1.35	2.50	2.70	3.10	3.48	3.80	4.12	4.42
No. of Wires n	9	10	11	12	13	14	15	16
$M=D/d$.....	4.67	4.98	5.24	5.45	5.68	5.90	6.10	6.30

The diameter of conduit required is based on runs of from 50 ft. with two 90 deg. bends to 150 ft. with one 90 deg. bend. For wires larger than 1 in. in diameter the conduit diameters are computed 15 per cent larger to allow for more difficult pulling.

To illustrate the use of the curves, let us take a typical design:

Data given:

Feeder for a three-phase balanced load of 1,000 kva., 2,300 volt, 60 cycle, 180 ft. long, with an allowable drop of 25 volts, using three single-conductor cables, varnished cloth insulations in iron conduit. Find size of cable and of conduit.

Solution:

Line current = 1,000,000 ÷ (2,300 × 1.73) = 251 amp. On line 2-1*a*, scale A, find 250; project this point up to the 180-ft. line and read 45,000 amp.-ft. on the 1-1*a* line. Project the 45,000 line to the 25-volt line in second quadrant and read No. 4 as the next larger wire. On line 3-2*a*, scale A, find 250 amp. and project to carrying capacity curve scale A for varnished cloth. This will give 210,000-circ.mil wire, or a No. 4/0 cable as the next larger size, but on account of having three conductors in the conduit we apply correction factor 1.09, giving conduit required 228,900 circ.mil., which calls for a 250,000-circ.mil single conductor stranded cable. Project 250,000 circ.mil from line *O*-3 to the V.C. 3,000-volt curve in the third quadrant and read outside diameter of cable on line *O*-4 to be 1 in. Project this to the "three wires" curve in the fourth quadrant and find the nearest conduit to be 3 in. If we decide to use a three-conductor cable, the outside diameter will be found to be 1.95 in. and for a short straight pull we can use a 2½-in. conduit, although for ordinary cases a 3-in. conduit would be required.

In any case where the problem is beyond the practical range of these curves in any single quadrant that computation may be made by the ordinary methods and the result used in continuing the solution by means of the curves in the three other quadrants. Another possible use of the graphical method is the reversed order of solving a problem, such as finding the largest diameter of wire in a six-wire circuit that can be pulled in a 2½-in. conduit. By projecting the 2½-in. conduit point from the 4-4*a* line to the "six wires" curve, we read 0.65 in. as the outside diameter of each of these wires.

We may also estimate voltage drops in a number of circuits when we know the sizes of conductors, lengths and normal loading.

Many other applications of the graphical solution will present themselves as the user becomes more familiar with the graph.

A Direct-Acting Automatic Regulator

Details of Design and Operation—Can Be Adapted to Voltage, Power and Speed Regulation, Automatic Synchronizing and the Limitation of Short-Circuit Current

By OTHMAR K. MARTI
Cornell University

IN ORDER to improve on the hitherto devised types of rheostatic regulators, solutions had to be found for the following problems:

1. The design of a control device sensitive to the smallest and most rapid variations of voltage and powerful enough to move a field rheostat without assistance from an auxiliary power source.

2. A field rheostat, operating practically frictionless, with a minimum of inertia in its moving parts.

3. A system of perfectly balanced moving parts free from reaction in every position.

4. An effective and simple anti-hunting device.

The design of the different parts and their general arrangement can best be explained by referring to Fig. 2. The control device is built on the principle of the induction motor. The stator laminations (*e*) are circular and carry a split phase winding. Concentrical with the stator pole faces is a cylindrical soft iron core, which completes the path of the field lines, leaving only a small air gap. In the field in this air gap is placed a thin hollow drum of aluminum (*c*) carried by a steel spindle, the latter being supported at both ends by jewel bearings. The electric torque produced by the current in the split phase winding is counterbalanced by a combination of two springs, which produce a constant torque whatever the position of the drum may be. A sufficiently high resistance is connected in series with the stator winding to prevent variations in temperature and small variations in frequency having any marked effect on the constancy of the voltage which the regulator is set to maintain.

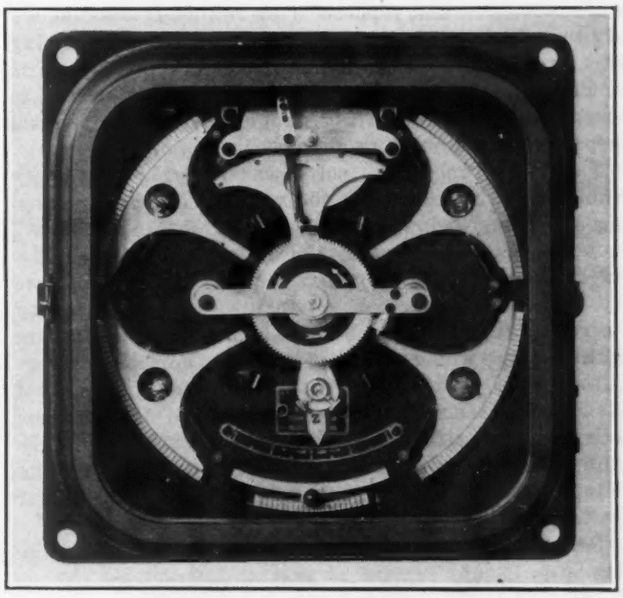


FIG. 1—FOUR SECTOR DIRECT-ACTING AUTOMATIC REGULATOR

The field rheostat with contact device is an integral part of the regulator. The stationary contacts (*l*) to which the resistance coils (*g*) are connected are arranged concentrically with the rotor spindle in two or four rows, depending upon the size of the regulator. The inner side of these contacts, facing the spindle, is provided with a V-shaped groove that serves as a guide

for the moving contacts. The latter have the shape of a sector, with a curved strip of silver or carbon as contact surface and a steel needle as pivot. The latter rests in a jewel cup, which is carried by a leaf spring supported from the rotor spindle. The rotor can be turned through an angle of 60 deg. and in doing so carries the two needle points over the corresponding arc of a circle. This causes the sectors to roll in the groove of the stationary contacts, putting in or cutting

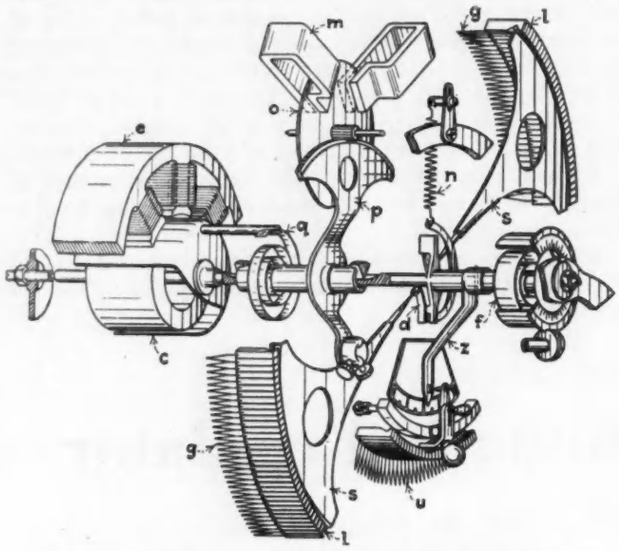


FIG. 2—MOTIVE SYSTEM AND MECHANISM OF DIRECT-ACTING REGULATOR

out resistance. The latter in the case of a generator voltage regulator is connected in series with the shunt field of the exciter, as shown in Fig. 3.

This design of the field rheostat entirely eliminates gliding friction and replaces it by rolling friction which is so small that it can almost be neglected. All moving parts are made of aluminum. Therefore the inertia is small, and as only small displacements are required to cover the whole regulating range, the moving system responds very quickly to changes in voltage.

The main problem to solve was to make the device stable—that is, to prevent the voltage continually surging above and below normal. If, for instance, a small drop in voltage occurred, the regulator would immediately answer by giving maximum excitation, because the slight overbalance of the spring torque would turn the rotor into the extreme right-hand position. As soon as the voltage would rise slightly above normal, the regulator would race into the other extreme position and put in all resistance. The voltage would fall and the cycle repeat itself indefinitely. The operation would be similar to that of a vibrating type regulator, and the voltage would fluctuate between an upper and lower limit.

This performance, however, is not desired, as the regulator should remain at rest as long as no change in excitation is required. It is therefore provided with an elastic recall device, the purpose of which is to stabilize its operation. It consists of an aluminum disk (*o*) rotating between two permanent magnets (*m*). The disk is geared to the rack of an aluminum sector (*p*), which can turn concentrically with the rotor spindle and is fastened to the aluminum drum (*c*) by means of a flexible spiral spring (*q*), acting as a recall spring. If a change in voltage occurs, the eddy currents induced in the disk (*o*) tend to resist quick response of the moving system. However, thanks to the flexible coupling, the drum, which directly controls the contact sectors (*s*), will immediately take up a position in which the torque of the various springs and the electrical torque are again balanced. The coupling spring between the drum and the disk is made weak enough to allow powerful over-regulation and yet maintain perfect stability.

Method and Cycle of Operation.—An elementary diagram of connections for the voltage regulation of alternators is shown in Fig. 3. The split-phase winding is connected across the terminals of the alternator, and the rheostat (*g*) in series with the field winding of the exciter. The cycle of operation is as follows: Assuming the generator fully loaded, the contact segments will then take up a position similar to the one shown in Fig. 3, in which a great part of the resistance is short circuited. This position does not change as long as the voltage remains constant, because the electric torque produced in the drum (*c*) is counterbalanced by the torque of the spring (*f*). A drop in load tends to raise the voltage, but the smallest increase is immediately followed by an increase of the electrical torque so that the system becomes unbalanced. As a result the sectors are displaced to the left till the mechanical torque, now increased by the torque of the recall spring (*q*), again equals the electrical torque. The resistance inserted in the field circuit by the displacement of the sectors is much in excess of what would be necessary to adjust the excitation to the new load condition. In this way the inherent inertia of the magnetic field is rapidly overcome and the voltage restored to normal. This causes the sectors to go back to the right, but since the tension of the recall spring has been reduced (because of the following up of the aluminum disk, to which its other end is connected through the geared quadrant) they come to rest in the position which corresponds to the correct excitation.

Line Drop Compensation.—For this function, use is made of the compounding resistance (*u*), which resistance is an integral part of every regulator. The current of the motive system and the secondary current from a current transformer connected in the line are superposed in this resistance in such a manner that, when the latter increases, the electrical magnetic torque decreases and the contact sectors are displaced until the alternating voltage reaches a corresponding higher value. A dial contact is provided, by means of which the effect of the compensating winding (*u*) may be varied and the regulator adjusted to compensate line drops up to 15 per cent according to the line requirements.

APPLICATIONS OF THE AUTOMATIC REGULATOR

Voltage Regulator.—The application of the regulator to the control of a single generator has already been described above; its application to the control of two or more alternators is the same as with the other types of regulators. It may only be mentioned that for parallel operation of several alternators connected to the same bus, in order to assure proper load distribution, a current element is incorporated as a standard in every regulator. This current element is connected to a current transformer in the generator mains and makes it possible to influence the regulator by the machine current in such a manner that any unbalanced distribution of the wattless current between the different machines working in parallel at once causes a readjustment of

the excitation current, which action ceases only after equilibrium has been re-established.

As an example of an actual installation the two automatic regulators in the plant of the Niagara Falls Power Company, where reliability is of the greatest importance, may be cited. These regulators control the voltage of two waterwheel-driven generators of 1,000-kva. capacity and 2,200 volts, 25 cycles, which supply energy to the motor-driven exciters of three 37,500-kva. alternators. The diagram of connection for the alternators with their regulators is practically as shown in Fig. 3 except that for stepping down the voltage and current instrument transformers are used. These regulators have been in satisfactory operation for more than two years and maintain constant voltage and equal power factor on both machines under all conditions of load. Another installation of two voltage regulators intended for the control of two 42,000-kva. alternators of the American Gas & Electric Company at its Twin Branch plant was recently put in operation.

Current Limiting Regulator.—This regulator is chiefly used with generators for limiting short-circuit currents, but may also be used as a load-limiting device, as in the case of synchronous condensers. It differs from the voltage regulator only in the split-phase winding, which is supplied from one or two current transformers inserted in the generator mains. The rheostat of the current-limiting regulator is connected in series with the rheostat of the voltage regulator and the exciter field winding. It is normally short circuited, but is gradually inserted as the generator current attains and tends to exceed the pick-up current for which the regulator is set, which may be adjusted to any value between one and two times full load. The combination of a voltage and current-limiting regulator for a generator assures complete control of the voltage under normal load conditions and of the current under short-circuit conditions in such a manner that as the abnormal conditions existing in a network due to short circuit or overload disappear the voltage regulator gradually and automatically resumes control of the voltage. The advantages of this system of regulation are obvious: (1) limitation of short-circuit current and armature heating; (2) longer setting of relays, which assures better selectivity; (3) no falling out of step of individual generators or interconnected power stations, because the synchronizing current is under control of the current-limiting regulator. Result: Fewer interruptions in the power supply, hence greatly increased continuity and reliability of service.

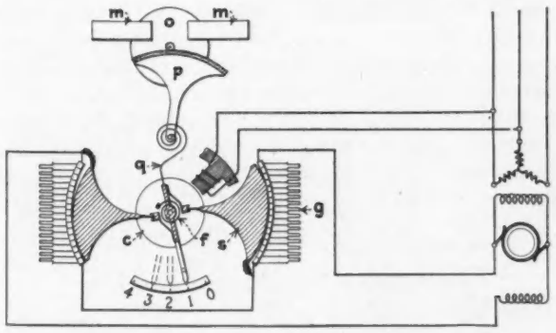


FIG. 3—DIAGRAM OF CONNECTIONS FOR REGULATING A SINGLE ALTERNATOR

Fig. 4 shows the diagram of connections of an actual installation of the above device together with an automatic voltage regulator at the plant of the Indiana General Service Company in Marion, Ind. Both regulators are in use with a three-phase, 6,250-kva. turbo-generator, 2,300 volts, 60 cycles, with a built-on exciter. The diagram of connection is self-explanatory and its operation can be deduced from the description of the voltage regulator above.

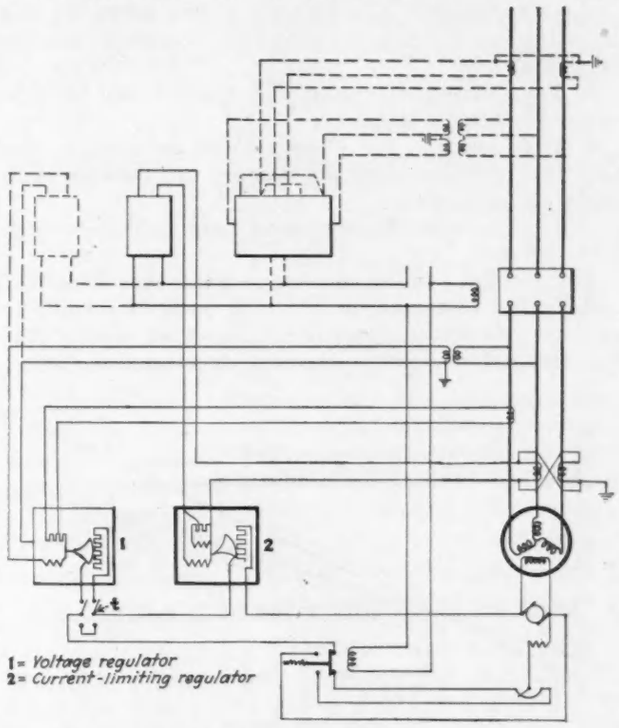


FIG. 4—DIAGRAM OF CONNECTIONS FOR CURRENT-LIMITING INSTALLATION

Automatic Synchronizer.—This device, similar to the voltage regulator, is provided with a specially designed synchronizing relay, which closes its contact at the moment of phase coincidence, making allowance for time lag in the control gear of the oil circuit breaker. For several alternators or incoming feeders only one synchronizer is necessary, the usual plugging arrangement being used. The apparatus can also be used for the synchronizing and tying in of two systems where no direct control of the frequency is possible, as it will utilize the first opportunity which presents itself for synchronizing. An interesting installation has been completed at the Shelby plant of the Ohio Power Company, where the synchronization of systems rated at 100,000 kva. will be required.

Control of Train-Lighting Equipment.—With the exception of a few minor details the device used for train coaches is the same as the one described for voltage regulation. Its purpose is to control the voltage of the dynamo and to keep it independent of the speed of the train in such a manner that on the one hand the battery can be properly charged and discharged, and on the other, constant supply voltage be maintained at the lamps. A series of tests recently made in this country by a manufacturing company of lighting and heating devices have demonstrated the accuracy with which the lamp voltage is maintained under various speed and load conditions. As a matter of fact, more than 14,000 train-lighting regulators have provided safe lighting for many years to millions of travelers abroad.

Letters from Our Readers

Basis for Service Costs Still Debated

To the Editor of the ELECTRICAL WORLD:

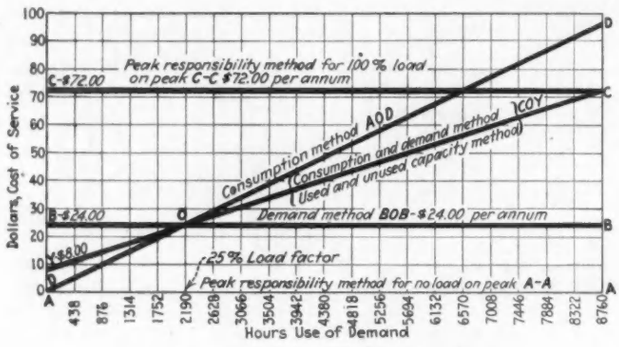
As I understand A. S. Knight in his letter in your issue for Oct. 2, he cannot accept the "theories" because he claims:

1. They have been proved accurate for only 100-per-cent-load-factor consumers.

2. They overlook the effect exerted on costs by the fact that different diversity factors are possible with the same load factors.

3. They assume capacity costs vary uniformly with load factors.

Mr. Knight admits the accuracy of the "theories" and the inaccuracy of the "demand method" for a 100-per-cent-load-factor consumer. He must admit that the "demand method" is accurate for a consumer whose



COST OF A KILOWATT-DEMAND CUSTOMER

load factor is the same as the weighted average load factor of all the consumers of a system; otherwise, he has no proof that the "demand method" is accurate at any load factor. The "consumption method" and the "theory methods" (the "consumption and demand method" and the "used and unused capacity method") each give the same value for the weighted-average-load-factor consumer as does the "demand method." It can be easily proved that all four methods must give equivalent results for such a consumer. The "theories," therefore, have been proved to be accurate at two load factors, and, since the expressions of the "theories" are equations for straight lines, they must be accurate at all load factors.

Mr. Knight also assails the "theories" because they overlook "the fact that consumers of the same load factor may have very different effects upon costs by producing very different diversity factors." Mr. Knight overlooks the fact that the "theory methods" do not attempt to single out those who create costs. If that is desired, resort must be had to the "peak responsibility method" or some modification of it. The "theories" allocate costs on the basis that diversities are uncontrolled and therefore the benefits of diversity are a community of interests. Mr. Knight further overlooks the fact that load factors, diversity factors and capacity costs have already been created before the "theories" are applied for the "allocation of capacity costs." The unit kilowatt-hour and kilovolt-ampere capacity costs obtained from the allocations will not give accurate consumer costs for future periods unless the weighted average load factor of the consumers in the future periods remains the same as during the first period and the capacity costs have increased or decreased directly in proportion to the increase or decrease of the consumers' coincident maximum demand.

Mr. Knight claims that the methods assume capacity costs to vary uniformly with load factors. The solution of the equations for the "theory methods" involves the actual diversity of the system $(D \div P)$, the potential diversity of the system $(D \div H)$ and the potential diversity of each consumer $(d \div h)$, thus proving that capacity costs do not vary with load factor and refuting Mr. Knight's claim. A casual examination of the results shown in columns five and six of the table of costs shown on page 1191 of the issue of your paper for May 29, 1926, offers further evidence in refutation of Mr. Knight's claim.

The inclosed chart, showing the costs of a one-kilowatt-demand consumer operating from no-load factor to 100-per-cent-load factor, computed by the "consumption method," "demand method," "consumption and demand method," "used and unused capacity method" and extremes of "peak responsibility method," may prove of value in clarifying the situation. It shows, the instability of the "peak responsibility method" and that the "consumption method" charges the 100-per-cent-load-factor consumer with costs in excess of true costs, the "demand method" with costs under true costs and the "theory methods" with the exact costs. It shows that the consumption, demand and "theory" methods charge the true costs at 25 per cent load factor. The "theory" method results in costs between the consumption and demand methods at all points other than the 25 per cent load factor. In the face of such a showing, can the "theories" be rightly accused of becoming misleading by a pretense of more nearly representing true costs than the "demand" or any other method yet published?

W. J. GREENE,
Rate Engineer.

Iowa Railway & Light Comporation,
Cedar Rapids, Iowa.

Thirty-thousand-Volt Generators in Italy

To the Editor of the ELECTRICAL WORLD:

In regard to the editorial in the ELECTRICAL WORLD of Oct. 16 on higher-voltage generators, let me call to your attention the fact that in the hydro-electric power station at Subiaco, supplying part of the power demand of the city of Rome, Italy, two 30,000-volt generators of several thousand horsepower output each were installed in 1905 and that these generators have been in operation for more than 20 years without a single breakdown. The machines were designed and built by Ganz and represent up to the present day the highest-voltage machines in the world.

A. PALME.

Pittsfield, Mass.

Electricity Supply in Berlin

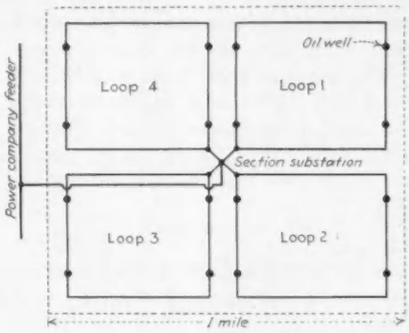
STRIKING indication of the rapid increase that is taking place in the German capital in the use of electricity for lighting and power purposes is given in the latest report of the Berlin Electricity Supply Company. During 1925 consumers increased from 273,787 to 369,205 and meters in use from 305,962 to 402,928. The output increased from 462,600,000 kw.-hr. in 1924 to 661,700,000 kw.-hr. last year. In order to meet the increasing demand, the plants at the existing Moabit and Rummelsburg power stations were extended, while the Charlottenburg station is being reconstructed. Work on the new superpower station at Rummelsburg is rapidly approaching completion.

Central Station and Industrial Practice

Oil Field Power Supply

BY E. D. FREEMAN
Oklahoma Gas & Electric Company

OIL FIELDS have an indefinite life and yet demand a large supply of considerable electric power immediately they are discovered. In several years of experience with this load the engineers of the Oklahoma Gas & Electric Company have found it the best practice to make oil field power supply on a temporary and inexpensive basis, but to apply full protection to lines and equipment. The normal procedure is to extend a 63-kv. wood pole line to the new oil field to a six-pole wood substation in its center. Transformers are mounted on a concrete base at this location. On the high-tension side air disconnects, S. & C. fuses and pole types of arresters are used. The 4,000-volt and secondary side is provided with automatic reclosing oil breakers. The substation supplies energy to a main feeder along the highway in the oil field. No. 2 to No. 000 bare wire is used on this feeder depending upon the load expected. The different oil companies then build their own line and provide their own transformers for tapping the main feeder of the power company.



SINGLE-LINE WIRING DIAGRAM FOR TYPICAL SECTION LAYOUT FOR BEAM PUMPING OF OIL

As an illustration, if beam pumping is to be done on a section of land, an oil company would locate a 4,000- to 440-volt substation in the center of the section. This station would tap the main feeder of the power company on the highway and four separate circuits would be installed on the secondary to operate each group of four wells on each quarter section. These loop circuits are usually No. 2 wire and supply power to 440-volt pumping motors. This section substation usually is equipped with oil fuses and arresters without choke coils and is of the pole type.

If the air process of oil recovery is used instead of beam pumping, a compressor station is located at the section substation and the loop circuits are omitted. This process offers a stable load of good proportions and a high load factor as a consequence compared with the beam pumping of oil where the demand is high and the load fluctuates.

Electrically Heated Babbitting Process

THE first complete installation by a street railway of electrically heated babbitting equipment is believed to be that which has been made recently by the Los Angeles Railway.

INSTALLATION OF ELECTRICALLY HEATED MELTING POTS AND PREHEATING OVEN FOR BABBITTING WORK

The installation consists of three electrically heated and automatically controlled General Electric melting pots and a preheating oven. In addition an electrically heated oakite cleaning tank and various metal-lined bins and benches made in the shops of the company have been installed.

Great effectiveness in the babbitting process is obtained by maintaining a uniform temperature with thermostatic control. This is set for the correct heat, which is then automatically maintained constant.

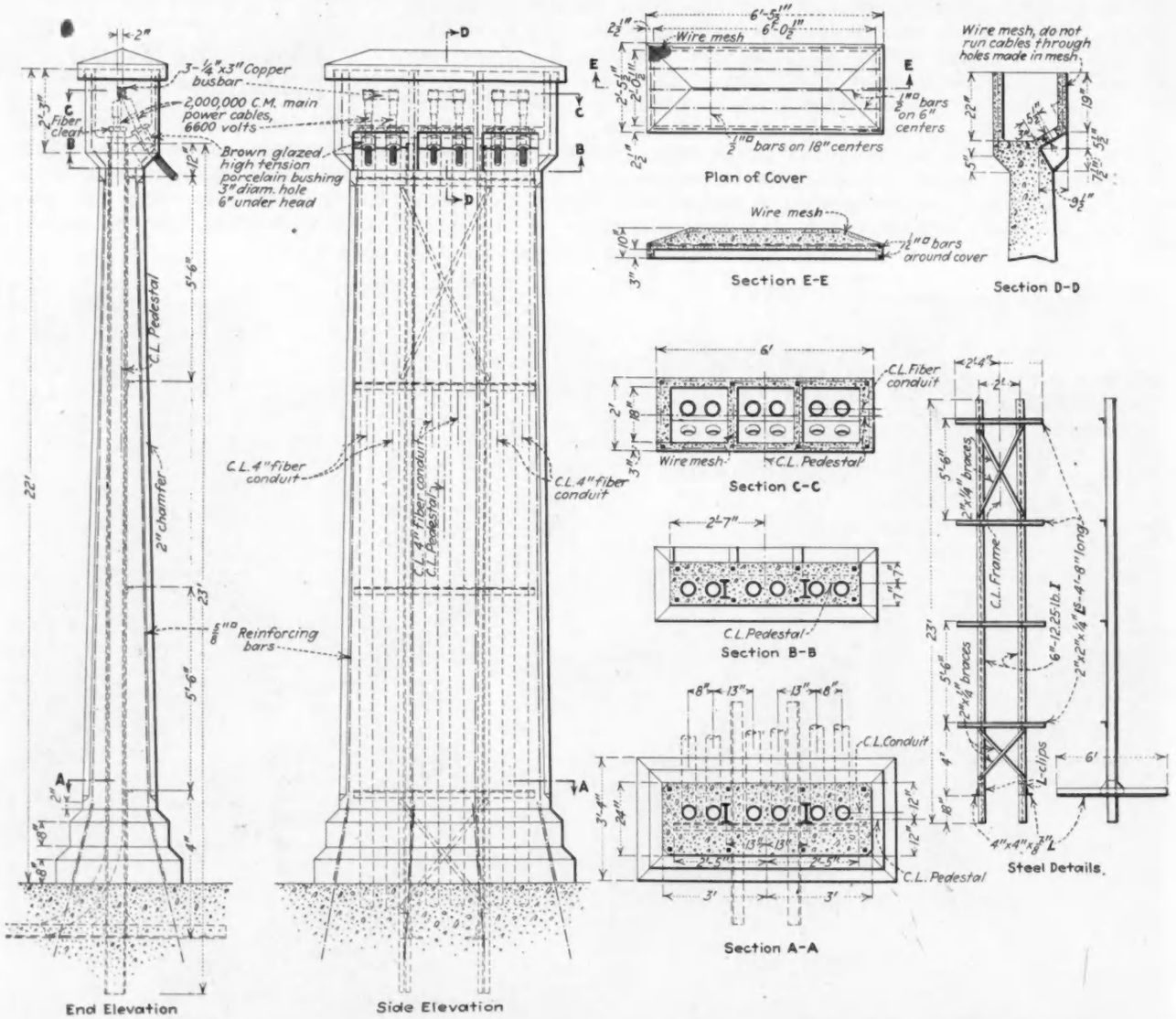
The oakite cleaning tank, the melting pots and the preheating oven are arranged in order to obtain the most efficient step-by-step process of production. The old shells that are to be rebabbitted are placed in the oakite cleaning tank and boiled until clean. They are then placed in the melting pot and all the old babbit metal is melted off. If allowed to cool, they are placed in the preheating oven and heated to the proper temperature for tinning. To make the tinning metal adhere, a flux is applied to the surface which is to be babbitted, and all other surfaces are swabbed with a clay wash to prevent adherence of the tinning metal.

The bearing shell is arranged with the proper mandrels and forms, and the babbit metal is poured into it with self-skimming ladles to insure a clean and uniform texture of the metal.

Concrete Terminal for Transformer Leads

THE terminal for power cables on the transformer slab of the Terrora hydro-electric development of the Georgia Railway & Power Company is illustrated in the accompanying drawings. This plant has a capacity of 20,000 kw. in two units and operates at a head of 190 ft. Cables are brought from the 6,600-volt generators to the outdoor substation in underground ducts and are then run up the concrete post to the three-phase transformer. By using a terminal post of this type, potheads for the low-tension cables are dispensed with.

A steel frame made up of two 6-in. I-beams 23 ft. long and four cross-members of 2x2x¼-in. angles 4 ft. 8 in. long is used. Six 4-in. fiber conduit and ⅝-in. square reinforcing bars are placed as shown. Of course, under no circumstances should a loop or circuit of iron be placed around any conduits or cables unless all six cables are inclosed in the same loop. The finished pedestal has a neat appearance and has been very satisfactory.



TRANSFORMER LEAD PEDESTAL IN THE TERRORA DEVELOPMENT OF THE GEORGIA RAILWAY & POWER COMPANY

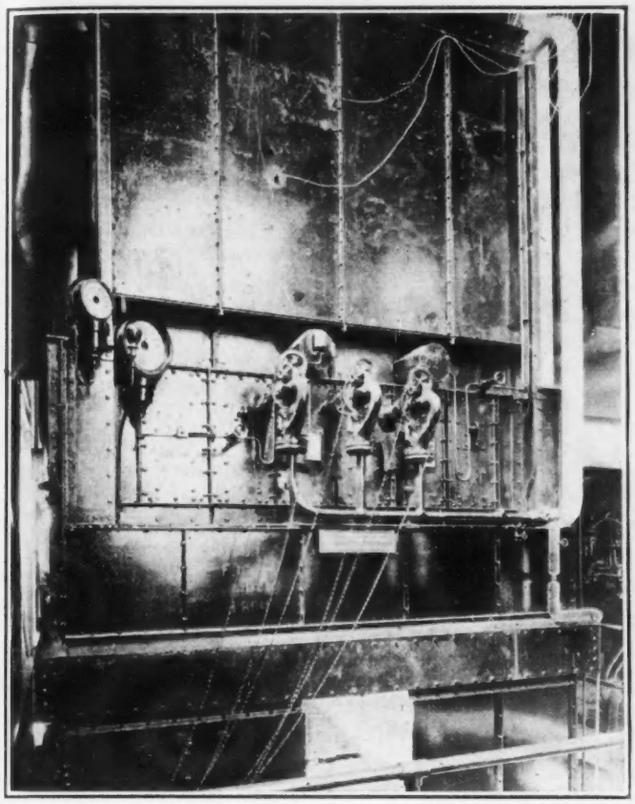


FIG. 1—UPPER FRONT OF MERCURY BOILER

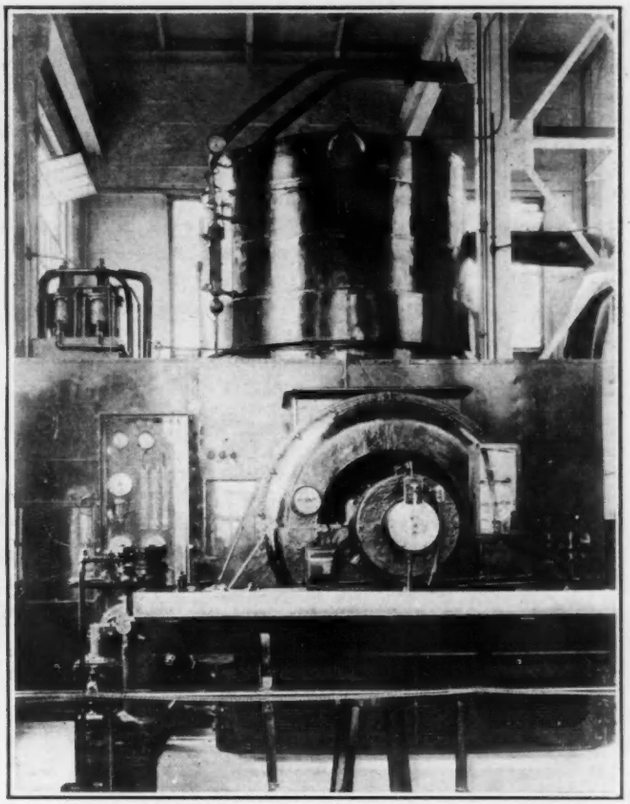


FIG. 2—MERCURY CONDENSER AND TURBO-GENERATOR

10,000 B.t.u. per Kilowatt-Hour in Sight at Hartford

JUDGING from tests of the mercury-vapor process at the Dutch Point station of the Hartford (Conn.) Electric Light Company, using 70-lb. gage pressure on the mercury boiler, an air heater to bring the flue-gas temperature down to 300 deg. F., and with the most desirable steam conditions, it should be feasible to deliver a kilowatt-hour at the switchboard with 10,000 B.t.u. fuel expenditure, according to comments made recently before New England system operators by L. A. Sheldon, assistant to W. L. R. Emmet, General Electric Company. "In general," he stated, "progress on this installation has been very satisfactory, and I think that in a short time you will hear that we are going ahead with the building of larger units. Present plans are for an equipment to deliver 10,000 kw. from the mercury turbine and 140,000 lb. of steam per hour."

Discussing recent experience at Hartford, Mr. Sheldon said that the present four-section boiler has tubes that function perfectly with a vapor output high enough to give a load of 1,700 to 1,800 kw. on the mercury turbine. At times the unit has operated with loads in excess of 2,000 kw. and 28,000 lb. of steam per hour, the fire temperature being about 2,900 deg. F. Under these conditions a few of the tubes showed burning at the lower ends, but a large percentage gave no trouble.

Improvements are now being made in the circulation of mercury within the tubes. The boiler has been taken apart and the fit between the filler block in the upper header and the down pipe is being changed to prevent slowing up of circulation caused by vapor being released near the down pipe and interfering with the entrance of the liquid into it. Tests show that with proper circulation of mercury there is no possible danger of burning the tubes, even with the higher loads contemplated, and no further trouble is expected from this source.

The use of illuminating gas in the condenser and boiler while shut down and in the condenser and sump in small amounts while running aids in keeping the mercury free, lively, non-adhesive and easier to clean. Nine months' operation has given no trouble from the stoppage of mer-

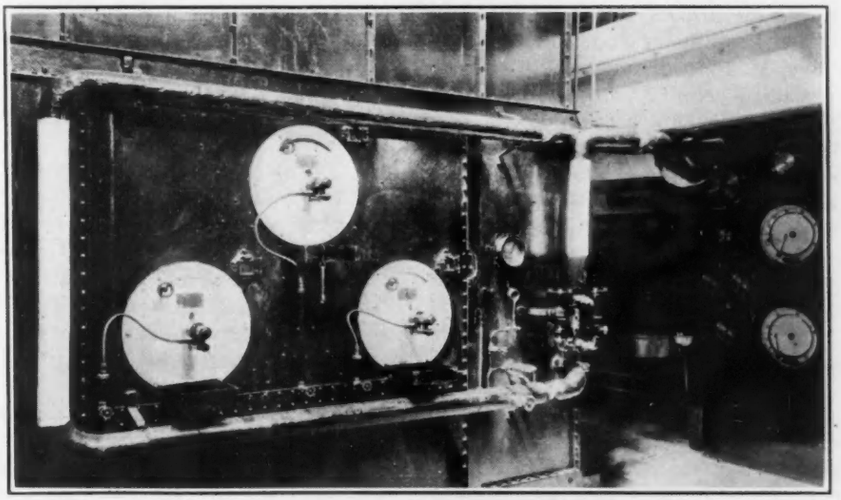


FIG. 3—LOWER FRONT VIEW OF MERCURY BOILER

cury passages in the heater or in the boiler. A test paper to detect the amount of mercury in the air has been developed. Its range is approximately between one part of mercury to 500,000 parts air and one part to 10,000,000 parts air. It has a coating of a compound of sulphur and selenium and has been standardized to give a quantitative result.

At present practically no trouble is being had from leaks. Welded joints have proved by far the most satisfactory, these being made heavier than the plate to force any slight movement to take place in the plate rather than in the weld. To date about 90 per cent of the welds have been made with the electric arc and 10 per cent with acetylene. The atomic hydrogen method of welding is coming into use and is valuable for chrome steel work.

An examination recently made of the present mercury turbine shows that the machine is in excellent condition. The shaft packings are practically perfect, and although there is a slight amount of cutting at the entrance of the third stage wheel and on the third stage nozzle, opposite this, indications are that with the new design of turbine in which the liquid from the packing can in no way get into the turbine wheels and which has drains for removing liquid from each stage, there will be very little cutting. The shell is also being designed to reduce expansion strains and thus eliminate any danger of cracking.

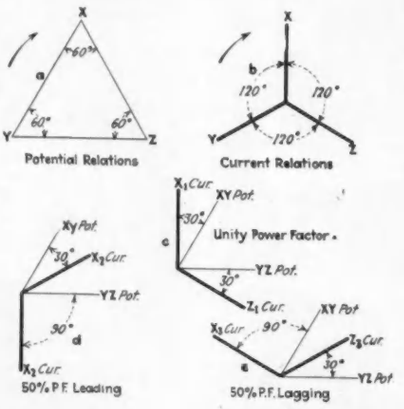
Cost of Recoppering a 66,000-Volt Line

THE New England Power Company is installing No. 2/0 stranded copper wire upon two three-phase circuits of its 66-kv. line between Leominster Junction and Millbury, Mass., a distance of 28.8 miles, replacing No. 2 copper originally installed on this section of its system. The insulation consists of six disks at strain, and a No. 2 solid copper ground wire. The estimated total cost of the job follows:

Power wire	$ 55,500
Towers	4,000
Ground wire and guying	4,000
Stringing power and ground wire	34,850
Insulators and hardware	8,450
Miscellaneous hauling and handling	4,000
Right of-way	5,000
Sub-total	$115,800
Contractor	11,500
Sub-total	$127,300
Engineering	6,300
Total	$133,600

Load Box for Three-Phase Meter Testing

WHEN the number of three-phase meters on a system is not large enough to warrant any great investment in testing apparatus, the meter man is frequently confronted with the necessity of building his own testing devices or of going without. Under such conditions a very satisfactory load box for testing



VECTOR DIAGRAMS OF METER CONDITIONS

three-phase meters with an artificial load at unity power factor, 50 per cent lag or 50 per cent lead may be easily and cheaply constructed which may make use of lamp banks or any other kind of non-inductive energy-consuming devices. The scheme is worked out in the wiring diagram and the possible load conditions indicated.

The materials for the device need consist only of a mounting board, preferably incased in a box, three double-throw, triple-pole knife switches, nine terminals and current-consuming means. For general use of the apparatus it would probably be desirable to have the loads separable from the device so that changes may be made according to the sizes of meters to be tested on the system.

Since one or the other of the meter elements does not rotate at all at 50 per cent power factor, lag or lead, the apparatus can also be used for indicating phase rotation and checking meter connections. A variant of this idea of phase displacement of non-inductive loads may be made to result in three-phase lagging or leading power factors of 86.7 per cent. Applications of it to high-tension meter testing by taking testing current from the meter potential transformers have been made, the load box sometimes containing transformers to increase current values without overloading the potential transformers.

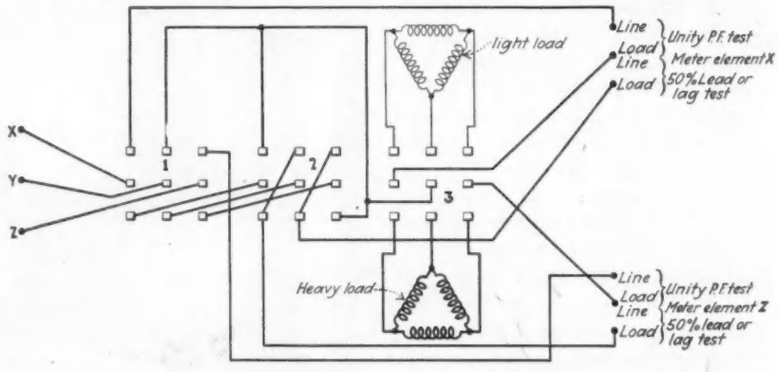
Preventing Water Hammer

THE three large centrifugal pumping units in the new sewage disposal plant in Brooklyn are arranged for automatic slow-down to prevent water hammer.

The pump motors are automatically started by a float switch, and when this closes, an oil circuit breaker is closed, thus throwing voltage on the primary of the motor. The motor then accelerates automatically until it reaches full speed.

When the pump motor is to be stopped, the float switch opens and a contactor drops out, thus inserting resistance in the motor secondary and thereby slowing it down. At the same time a definite time relay is energized, tripping after a predetermined time, thus opening the oil circuit breaker and shutting down the motor.

The three pumps are driven by 125-hp., 4,150-volt, slip-ring motors. The Brooklyn plant is one of the first installations in the country where such provision is made.



Switch Up	Down
1	Non-Inductive / Inductive
2	P.F.-50% lag / P.F.-50% lead
3	Light load / Heavy load

WIRING AND SWITCHING SCHEME FOR LOAD BOX

Commercial Activities and Public Relations

Store Demonstrations Sell Electric Ranges

SEVERAL years' experience in selling electric ranges has led H. H. Courtright, president and manager of the Valley Electrical Supply Company, to the opinion that small store demonstrations are productive of more sales than the large newspaper and manufacturers' cooking schools that have been found so successful in many sections.

The Valley Electrical Supply Company is a subsidiary of the San Joaquin Light & Power Corporation, Fresno, Cal., and handles all appliance merchandising for that company. In addition to maintaining stores in Fresno and Bakersfield, the Valley Electrical Supply Company has an agent-dealer plan under which dealers in the territory served by the central station may participate in the sale of ranges and other appliances on a mutually profitable basis with the Valley Electrical Supply Company.

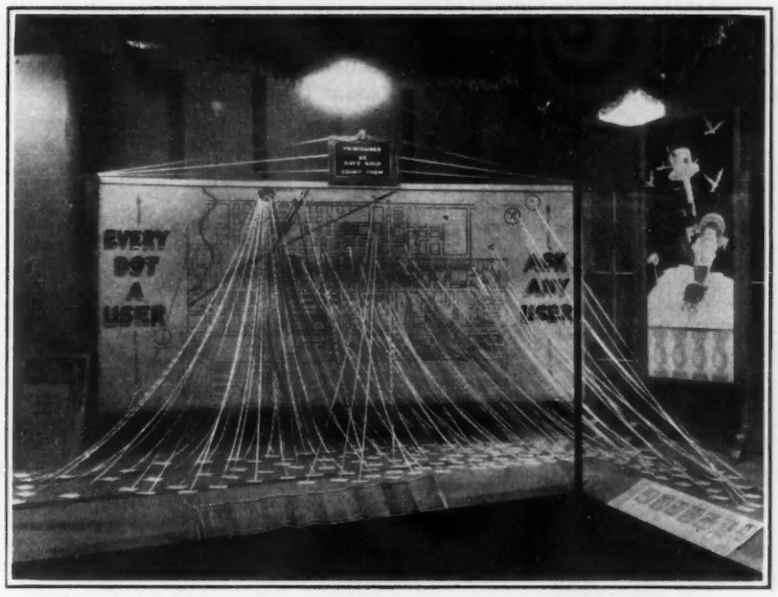
"Under this arrangement," says Mr. Courtright, "we advertise that a cooking demonstration will be held in the store of our local agent-dealer and invite all interested to attend." These demonstrations are not limited to a few hours in the morning or afternoon, which would assemble large and unwieldy crowds, but instead the demonstrator gives what might be termed a continuous demonstration, starting with the opening of the store and lasting all through the day. This plan has the advantage that electrical cooking is ever being demonstrated to small groups of women, any one of whom may unhesitatingly ask any questions she may wish.

The dealer and the demonstrator co-operate in taking the names of all likely prospects, and these are turned over to the Valley Electrical Supply Company's salesmen to follow up. "In this way we have secured more live prospects and made more actual sales than were ever realized during the course of our former elaborate and expensive cooking schools," says Mr. Courtright.

The large cooking schools were effective in bringing electrical cooking to the attention of large numbers and their publicity features were desirable, but because of less desirable angles, they were finally discontinued. The large and unwieldy nature of the crowds, timidity of women to ask questions, hard feelings over the awarding of prizes and high cost are some of the reasons given by Mr. Courtright for discontinuing the large demonstrations.

Electric Refrigerator Users Shown by Map

AN EFFECTIVE method of stimulating interest in the sale of electric refrigerators was employed recently by the Ohio Public Service Company in its Alliance division, where one of the display windows was utilized as shown in the accompanying illustration. A map of the city, at the back of the window, served to call attention to the number of electric refrigerators already in use in the territory. Red thumb tacks were used to indicate commercial units and blue tacks to indicate domestic installations. Streamers led from the map to cards giving the sizes of machines installed, and the whole display served as a silent testimonial to the increasing adoption of electric refrigeration by the company's customers. The display has proved effective in attracting attention.



MAP SHOWING USE OF ELECTRIC REFRIGERATION IN COMPANY'S TERRITORY

District Representative Plan for El Paso

OWING to the difficulties under which the five groups of "contact" employees work under present plans of central-station organization, Manager Tom P. Walker of the El Paso Electric Company proposes to place in effect a district representative plan. Meter readers see all customers once a month, but time does not permit them to form a really personal contact. The four other groups—collectors, salesmen, specialists and service men—have to restrict their visits to certain classes of customers. Sometimes during special campaigns salesmen visit every family in town, but it is a sort of hit-or-miss proposition.

The district representative plan will divide the city into districts and place a capable man in charge of each district. Men selected will be company employees, preferably men who live in the district to which they are appointed. Each district will include about 1,000 customers. Under the plan the district representative will visit each customer in his district once a month and spend sufficient time in each home to get acquainted and inject a personality into the company's service. To the customers in a district this man will

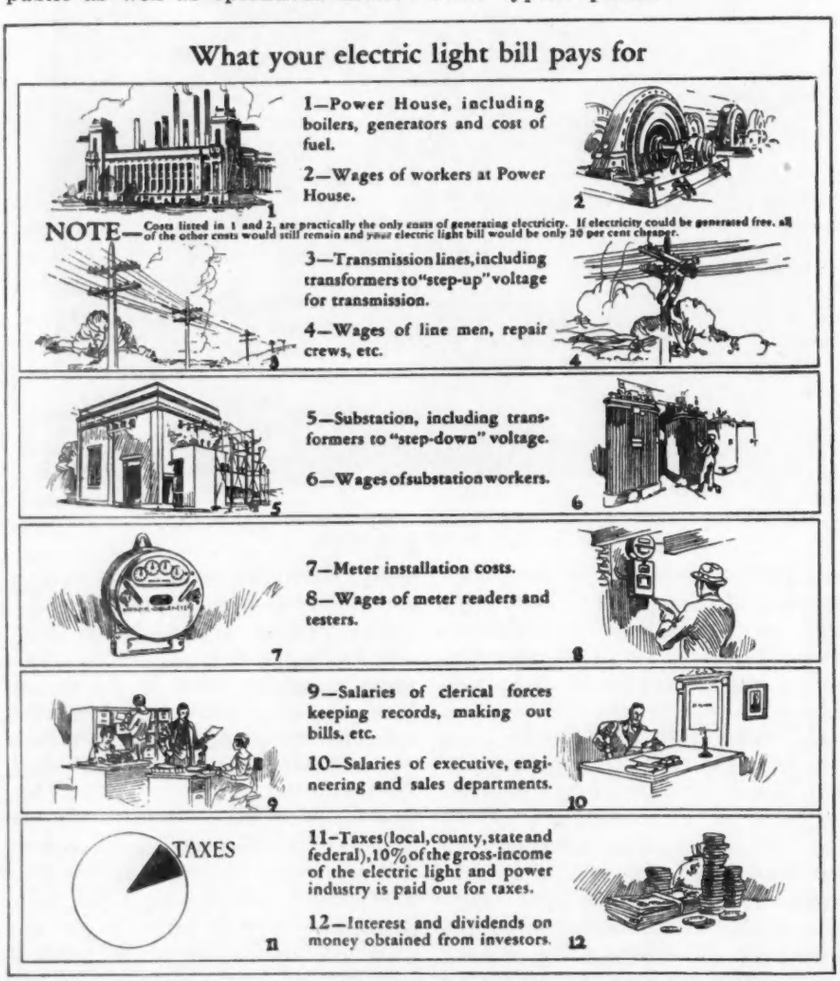
be the "company." Reading meters, making collections and minor service repairs will require about half of the time of the man, the remainder to be spent in selling himself and his company to the people of the district. District representatives will also act as salesmen and will report to the sales manager, W. R. Bell.

Four district representatives will be appointed at first and if the plan proves as successful as expected, about sixteen districts will later be created.

Picturing Utility Investment and Labor to Lay Mind

SOME electric-service companies have recognized the necessity of doing something besides merely telling their customers that there is a large fixed and operating expense existent in operating utilities that would prevent appreciable reduction of rates if energy could be generated for nothing. Picturing components of the system used in serving the public as well as operations involving labor is one way of enabling the lay mind to visualize the various sources of fixed and operating expenses. Supplementing such typical illustrations with figures to show major groups of investments or operating expenses constitutes another step in this educational work with the public.

The accompanying illustration, which forms a part of a folder being sent to members of the United States Senate, House of Representatives and Cabinet members, governors, mayors, jurists, bankers, publicists, etc., by the Wagner Electric Corporation, has been reproduced by the Union Electric Light & Power Company, St. Louis, Mo., in one of its house organs for public enlightenment. Other companies show a few typical pictures of their own power plants, transmission lines, substations or the like and emphasize the total investment in each group of structures along with the total system investment; similarly with groups of operating expenses, the cause of which can be illustrated by some typical picture.


What your electric light bill pays for
1—Power House, including boilers, generators and cost of fuel.
2—Wages of workers at Power House.
NOTE—Costs listed in 1 and 2, are practically the only costs of generating electricity. If electricity could be generated free, all of the other costs would still remain and your electric light bill would be only 30 per cent cheaper.
3—Transmission lines, including transformers to "step-up" voltage for transmission.
4—Wages of line men, repair crews, etc.
5—Substation, including transformers to "step-down" voltage.
6—Wages of substation workers.
7—Meter installation costs.
8—Wages of meter readers and testers.
9—Salaries of clerical forces keeping records, making out bills, etc.
10—Salaries of executive, engineering and sales departments.
TAXES
11—Taxes (local, county, state and federal), 10% of the gross income of the electric light and power industry is paid out for taxes.
12—Interest and dividends on money obtained from investors.

UTILITY REPRODUCES THIS ILLUSTRATION FOR PUBLIC ENLIGHTENMENT

Utility Requirements for Street Lighting

IN A recently issued street-lighting service manual, the Public Service Company of Northern Illinois has stated definitely and clearly the requirements of customer-owned street-lighting systems if they are to be connected to its lines. Perfect understanding of these requirements by salesmen and prospective users are expected to do much for the maintenance of harmonious relations. Quoting from the manual, the requirements are:

A.—The customer shall furnish the entire installation.

1.—For an ornamental street-lighting system, including the lighting units, lamps, lighting unit standards, underground cables, transformers, time switches and the constant-current street-lighting regulators for supplying constant current from the company's existing constant potential system.

B.—Repairs and maintenance expense to be borne by customer.

1.—The customer shall bear the expense for all repairs and replacements for an ornamental street-lighting system, excepting the renewal of incandescent lamps, the cleaning of globes and the patrolling of the system, including winding and setting time switches.

2.—If the customer desires the company to do the actual repairing and maintenance of posts, globes and all other appurtenances thereto, the customer shall pay for such repairs and maintenance at the company's standard rates for time and material.

C.—Repairs and maintenance expense to be borne by company.

1.—The company shall bear the expense for renewals of burned-out or otherwise defective incandescent lamps and shall clean the lighting unit glassware and patrol the lighting system.

D.—The company shall furnish all electrical energy.

1.—For lighting the lamps of all sizes, types and burning hours specified by and contracted for by the customer. No other electric lighting service shall be used by the customer on the same installation in conjunction with the company's service, either by means of a throw-over switch or any other connection.

Service Connection.—When the installation of the street-lighting system has been approved by the com-

pany, the company shall, at the expense of the customer, connect said street-lighting system to the company's existing electrical distribution system at the nearest available point or points, such point or points to be designated by the company.

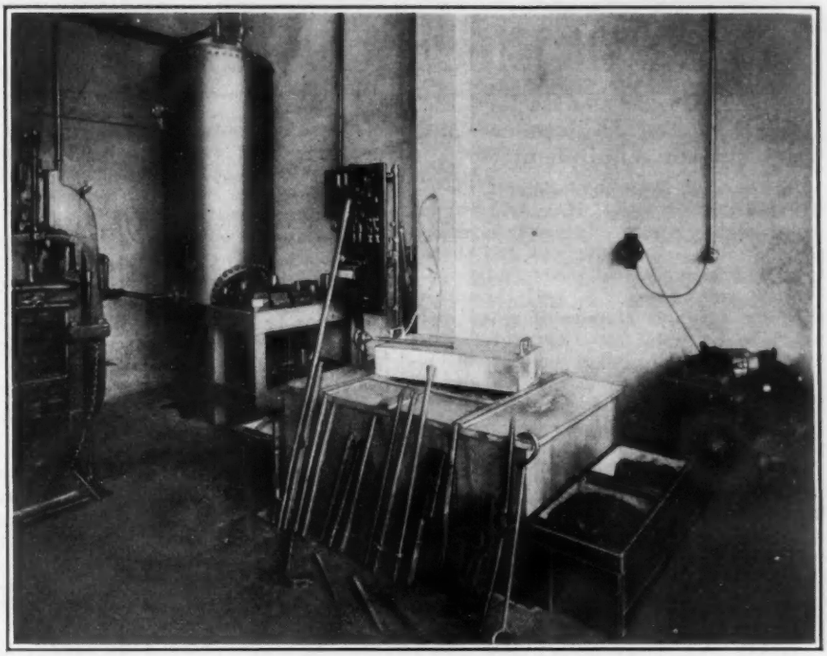
Lead-Bath Furnace Improves Tool Hardening

BY J. L. FADEN
Industrial Heating Engineer Edison Electric Illuminating Company of Boston

IN THE tool room of the general service buildings of the Edison Electric Illuminating Company of Boston, Mass., increased production facilities recently became necessary in shaping and hardening equipment used by the maintenance-of-lines department. Hand forging at a coal-fired unit was too slow and was accompanied by undesirable spoilage. The arrangement of the tool room was revamped and a 23-kw. electric furnace was installed for operation on 230-volt, single-phase service.

The outfit has a capacity for heating about 150 lb. of steel per hour and consumes from 16 to 18 kw.-hr. per hour in this service. Lead is contained in a heat-resisting alloy pot about 8x24x14 in. in dimensions, the pot being provided with an insulated sliding cover, which eliminates excessive radiation loss from the surface of the lead and allows a sufficient opening for the work in hand. A layer of coke and charcoal is placed on the surface of the lead further to reduce the radiation loss and keep the surface of the lead from oxidizing. Bull points, pick points, cold chisels, star drills, digging bars, hard drills and crowbars are the principal tools heated in the furnace. All forging is performed at a moderate heat and the temperature of the furnace is automatically maintained at 1,600 deg. F.

Prior to the installation of the electric lead-bath furnace careful consideration was given to a proper medium for heating the steel. Conventional practice had been to use a box-type furnace heated by gas or oil. Close temperature control with this type of equipment was very difficult and required more or less constant attention on the part of the operator. If the operator was careless, overheating and losses resulted. The electric lead-bath furnace is particularly adapted to this type of work, as only localized heating is required for several inches at the end of the tools. When the furnace is in use, the operator places the various tools in the molten lead at a slight angle with the surface of the bath. Due to the fact that the specific gravity of lead is higher than that of steel the tools float in the lead with the ends submerged. While the tools are heating in the furnace the operator can turn his attention to other matters without fear of the steel becoming overheated, as would be the case with oil or gas-fired furnaces.



ELECTRIC FURNACE GIVES FOUR TIMES COAL-FORGE PRODUCTION

It can readily be seen that steel that is overheated or burned will not last long under the strenuous duty to which it is subjected when used for digging, drilling or other purposes. In the electric furnace the proper heating of the steel can best be realized due to the low temperature gradient and the uniformity of the temperature. The advantage of uniform heating is most apparent in the hardening operation. The temperature for hardening depends, of course, on the carbon content of the steel. Any departure from the proper temperature when the steel is quenched will have an effect on its physical properties and durability.

The electric heating method has the following principal advantages: (a) Rapid heating due to storage of heat in the lead and rapid conduction of heat to the immersed metal; (b) elimination of oxidation of steel on account of absence of flame; (c) close temperature control; (d) localized heat where required. In this installation four times as much work is done as with the coal-fired forge. The cost of the furnace and control equipment complete was $1,800, of which $200 was the cost of installing. The furnace was designed and installed by the Lord Electric Company, Boston, the Edison company's engineering department handling the detailed layout.

Georgia Company Facilitates Customer Contacts

THE Georgia Railway & Power Company is planning to open two retail stores in addition to its main downtown store as a means of extending the sale of electric and gas appliances in Atlanta, Ga. For a number of months a branch retail store has been maintained in Decatur, Ga., near Atlanta, where the Georgia Railway & Power Company has displayed and sold electrical appliances as a convenience to customers who did not wish to make the trip to the main retail department in Atlanta. Now it is proposed to open two other retail branch stores in as many "community centers" in the city for the purpose of giving better service. Both stores will be miniatures of the company's main store and will carry a complete line of electric and gas appliances. A department will be maintained in each store where persons living in the community may pay their electric light and gas bills without the necessity of going to the main office down town.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Waste-Heat Boilers in Steel Mills.—F. H. WILLCOX and J. C. HAYES, JR.—For waste-heat boilers rapid water circulation is not a prime requisite, but there must be maximum heat recovery by conduction and convection, and therefore the most intimate contact of gases and water-heating surface. Close tube spacing in a water-tube boiler and gas velocities higher than those of natural draft in the fire-tube boiler are essential. Water-tube and fire-tube boilers are compared in this paper on the basis of heat transfer and draft loss. Various types of gas flow are discussed. Rules are laid down for the permissible loss in energy to provide forced draft in waste-heat installations. A number of typical installations are discussed by the authors. The economic value of the recovery of waste-heat in open-hearth steel furnaces, in cement-kilns and in other applications is dealt with.—*Mechanical Engineering*, October, 1926.

Generation, Control, Switching and Protection

Largest 3,000-R.p.m. Generators.—L. KROPF.—The trend of turbo-generator design seems to be toward increase of speed even on the very largest units. Formerly four-pole and six-pole machines for 1,500 r.p.m or 1,000 r.p.m. were the rule, but today preference seems to be given to two-pole types for 3,000 r.p.m. for units up to 40,000 kva. This means an output of 20,000 kva. per pole. Only the use of very best chromium-nickel steel and the total elimination of all cast parts makes it possible to build machines with such highly stressed materials and still remain within permissible safety limits. While generators of this type are fully as reliable as lower-speed machines, their over-all cost is 25 per cent less. A self-ventilated generator for 32,000 kva. at 3,000 r.p.m. is described in detail. Its efficiency at full load and 80 per cent power factor is 95.8 per cent, requiring 80-kw. excitation. With an inherent reactance of 15 per cent a dead short circuit of 43,000 amp., or about ten times normal load current, was measured oscillographically. External reactors are therefore not required for the protection of this generator. Dismantling of the machine after this severe short-circuit test disclosed no noticeable effect upon the windings. A mechanical overspeed test of 3,900 r.p.m. had also no effect upon the construction. Stator and rotor of the generator weigh 80 tons.—*Siemens Zeitschrift*, September, 1926.

High-Voltage Direct-Current Generators.—TH. PEDERZANI.—With the advent of the modern vacuum tube a demand for high direct-current voltage, to be used as anode potential, arose. Up to 15 kv. at 100 watts to 100 kw. are required. While the outer appearance of dynamos for such high voltages does not differ materially from standard machines, their design calls for great specialization. Hitherto the old drum-type armature with machine-formed coils was adapted for these generators. The results were not satisfactory for two reasons. The inactive part of the winding, extending on either side of the armature iron, grew out of proportion. For example, the coil heads on a 3½-kw., 5,000-volt dynamo extended at the right and left fully 80 per cent of the diameter of the armature. This made the axial length of the machines prohibitive. The other disadvantage was that if an armature coil burned out, the entire armature had to be rewound. Great improvements were recently brought about by a new type of high-voltage dynamo for outputs up to 100 kw., with a hand-wound Gramme ring. This eliminates entirely inactive winding and permits replacement of any damaged coil on the ring. High-frequency commutator noise cannot be avoided completely unless condensers and choke coils are connected to the generator. A 17-kw., 5,000-volt dynamo of this new design, with only one commutator, is described and shown in a sectional drawing.—*Elektrotechnik und Maschinenbau*, Aug. 29, 1926.

Transmission, Substations and Distribution

Automatic Railway Substations in Japan.—C. E. VALENTINE and W. L. NEWMEYER.—The Imperial Government Railways of Japan became interested in the use of automatic switching equipment for railway substations early in the development of their plans for electrification. The present railway electrification for interurban service employs 1,200 volts and 1,500 volts at the trolley. For future service the use of 1,500 volts throughout is contemplated, this voltage being preferred to a higher one because of the limits imposed by the 3-ft. 6-in. gage track. The author comments upon the interesting fact that although the cost of labor in general is so much lower in Japan than in the United States, the labor cost does not appear to be a large factor in deciding upon automatic switching equipment, the primary requisite being to secure reliability of operation and the greatest possible continuity of service. Several of the stations now in operation in Japan are discussed, and a description is given of details of arrangement and operation of their equipment. The article concludes with details of the sequence of operation for some automatic equipment. — *Electric Journal*, October, 1926.

Improved Steel-Concrete Poles for Power Transmission.—T. M. CAREY.—In the *Electrical Engineer* of June, 1925, a description was published of the patent steel-concrete poles, known as Stobie poles, which are being used by the Adelaide Electric Supply Company, Ltd., for its country transmission lines. In this article Mr. Carey describes recent improvements that have been made in the design and construction of the Stobie poles.—*Electrical Engineer of Australia and New Zealand*, Sept. 15, 1926.

Units, Measurements and Instruments

Flux Voltmeter for Magnetic Tests.—G. CAMILLI.—A voltmeter for alternating-current circuits is described in this article, the voltage indications of which are directly proportional to the maximum flux density, regardless of the wave shape of the voltage. While the instrument is suitable for many varieties of magnetic tests, its most important application, according to the author, is to the reduction of transformer core-loss measurements to a sine-wave basis. Test data indicate excellent accuracy for the meter in this application in comparison with other schemes or outfits in use at the present time for the purpose. Losses determined by this new meter are appreciably larger than those determined by the older methods. The new meter makes it unnecessary to use large generators to reduce the wave distortion caused by transformer excitation loads and permits the use of any generator that will carry the load thermally.—*Journal of the A.I.E.E.*, October, 1926.

Illumination

Production of Flicker in Electric Lamps by Cyclic Irregularity in the Voltage.—This investigation, of which the results are embodied in a report received from the British Electrical and Allied Industries Research Association, was undertaken at the Faraday House testing laboratory to ascertain the limits observable by the human eye of cyclic irregularity in the voltage of the supply to electric incandescent lamps. An investigation has been carried out by K. Simons which tends to show that the eye is most sensitive to flicker occurring with a periodicity of about 6 cycles per second. It is also shown that the percentage variation of light which can be detected by the eye decreases with large increase of intensity of illumination.—*Journal of Institution of Electrical Engineers (England)*, October, 1926.

Motors and Control

Theory and Development of the Interpole Motor.—MALCOLM MACLAREN.—In presenting this paper the author has enlarged its scope so as to trace the development of the direct-current machine in general, showing how the theory of its operation has emerged from the crude conceptions of one hundred years ago and how increased knowledge has led to improvements which have culminated in the interpole construction of the modern machine. In this connection he considers some of the problems of design, showing how general proportions may be selected and illustrating the application of these principles by reference to some recent typical installations. — *Journal of Franklin Institute*, October, 1926.

General Theory of the Single-Phase Induction Motor.—G. WINDRED.—This article represents a review of some of the more important theorems which are of use in connection with the theory

of the operation of the single-phase induction motor. Particular attention is paid to an investigation of the magnetic circuit, as the distribution of flux under various conditions is an important point. Analysis and practical application of trigonometrical theorems are included.—*World Power (England)*, October, 1926.

Electrophysics, Electrochemistry and Batteries

Significance of Magnetostriction in Permalloy.—L. W. MCKEEHAN.—This is a discussion of magnetostriction in permalloy and changes under tension giving evidence for the consecutive orientation of atoms by magnetic fields or by mechanical stresses. Magnetostriction in permalloy confirms qualitatively the existence of atomic magnetostriction and the explanation based thereon for high magnetic permeability and low hysteresis in these alloys. According to the author, the effect of tension upon magnetostriction suggests that orientation of the magnetic axes or iron and nickel atoms precisely like that due to the application of magnetic fields may be effected by mechanical stresses within the elastic limit. A connection between magnetic hysteresis and mechanical hysteresis is suggested, and the molecular field postulated by Weiss is interpreted as the integrated effect of local mechanical stresses.—*Reprint B-202, Bell Telephone Laboratories*, August, 1926.

Electric Production of Phosphorus.—P. BUNET.—Pure phosphorus has such limited use that its manufacture on a large and economical scale has hitherto not been found necessary. Save in the match industry and for certain steel and bronze alloys requiring annually only a few thousand tons no use exists. But there is a very large and rising demand for phosphoric acid and allied compounds for agricultural requirements. More than one-half of the world's supply of phosphoric acid comes from France, particularly from her Tunisian possessions. The article describes a number of electrochemical methods for the direct or indirect production of phosphoric acid with phosphor-tri-calcite $(PO_4)_2Ca_3$, coke and quartzite in a large one-electrode electric furnace. For a 1,000-kw. furnace an average of 1 kg. phosphoric acid for every 12 kw.-hr. may be expected. The process of Liljenroth is described in great detail.—*Revue Générale de l'Electricité*, Sept. 11, 1926.

Traction

Electric Vehicles for Town Delivery Work.—C. L. PRUYN.—It is expressed as the purpose of the author to define in this paper the limits within which each of the three types of delivery equipment mentioned may be expected to operate more efficiently—incidentally demonstrating the superiority of the electric battery as motor power within the field marked out for it. As an introductory means to that end the writer enumerates and examines the data upon which a discussion regarding the true field of usefulness of each delivery unit may be based. The power—horse, petrol or electricity—to be applied to local hauling should depend upon the following factors: (1) Load, (a) light (1 ton or less), (b) heavy (over 1 ton); (2) mileage per day, (a) short (10 miles per day or less), (b) average (over 10 and less than 50 miles), (c) long (over 50 miles); (3) number of stops, (a) few (less than 50), (b) many (over 50); (4) number of hours in working day, eight; (5) distribution of time between runs and stops. With all possible latitude for deviation in either direction, a careful analysis of admissible combinations of the factors listed above justifies the decision, according to the author, that, with very few exceptions, deliveries can be made most economically and efficiently under the following tabulated conditions:

		Mileage (Few Stops)		Mileage (Many Stops)	
Loads	Short	Average	Long	Short	Average
Light..	One horse	Electric	Gasoline	Electric	Electric
Heavy.	Team or electric truck	Electric	Gasoline	Electric	Electric

The author says that the requisites of the ideal delivery vehicle are reliability, simplicity of construction and operation, long life, low operation and maintenance costs, low fire hazard, speed easily controlled, low preliminary costs and an unlimited radius of operation. Except as regards the last too items, he believes the electric vehicle to have the advantage. — *Electric Vehicle*, September, 1926.

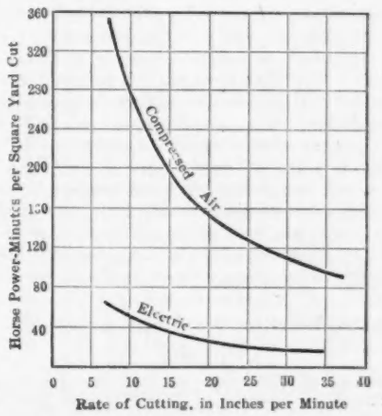
Telegraphy, Telephony, Radio and Signals

Recent Developments in the Recording and Reproduction of Sound.—S. T. WILLIAMS.—This paper was presented before the Franklin Institute in April by the chief engineer of the Victor Talking Machine Company. It contains a general résumé and in many instances a detailed description of the developments in the recording and reproduction of sound. Intelligible sound was first mechanically produced at the beginning of modern science in the seventeenth and eighteenth centuries. As a result a number of machines were made which could produce speech sounds, words and in some cases entire sentences. During the pioneer days of 30 to 35 years ago the talking machine, although a commercial article, was still a crude device. The motive power was supplied through a hand crank and the speed controlled by a governor much like those used on modern motors. Later came the spring motor that gave the turntable a more uniform speed. During the next eighteen years many refinements were made in recording processes and in materials used in the manufacture of records. Preceding his description of recent developments in the art, all of which, according to him, have appeared during the past year, the author presents a short review of the nature of sound, with special attention to the requirements for its accurate reproduction. An interesting comparison has been included in the paper between the old and new methods of recording, differences which account for the elimination of distortion of sound waves.—*Journal of Franklin Institute*, October, 1926.

Miscellaneous

Hydraulic Laboratories at Verkstaden, Kristinehamn, Sweden.—HADAR LIND. — A testing station was constructed in 1906 at a waterfall situated inside the factory's boundaries, which had a gross head of about 6 m., of which, however, only 4 m. to 5.5 m. was used as effective head for testing purposes. In 1914 a laboratory was added for the study of model turbines of very small dimensions, this laboratory being, the author believes, the first of its kind. The laboratory was intended for experimenting with a head of 1 m. and on model turbines with an output of 0.8 hp. to 1.5 hp. Gradually all new research work has been transferred to this laboratory, so that the original testing station, although it is in operation during the greater part of the year, is exclusively used for checking by tests on a larger scale the types of turbines which have given the best results in this newer laboratory. The laboratory was completely rebuilt on a larger scale in 1922, though many of the existing arrangements were maintained in principle. Through this reconstruction, which embodied all experience gained in this field, there was obtained a turbine laboratory which is believed to be a model as regards both the equipment and the accuracy of the work accomplished.—*Engineering (England)*, Sept. 24, 1926.

Applications of Machinery at the Coal Face.—SAM MAVOR.—The necessity for reduction in the cost and price of coal is considered, and the use of labor-saving machinery in the primary processes of winning coal is indicated as the most effective means by which the high labor cost can be substantially reduced. The evolution and early history of coal cutters are outlined, the later developments of these machines are indicated, and the leading characteristics of the bar, chain and disk coal cutters are detailed. Conveyors for underground use are described, and an outline is given of their place in the practice of intensive mining. An endeavor is made to indicate the respective spheres of electricity and compressed air for actuating coal-face machinery. —*Journal of Institution of Electrical Engineers (England)*, October, 1926.



ENERGY USED AT VARIOUS RATES OF CUTTING BY COMPRESSED AIR AND ELECTRIC COAL CUTTERS

New Books

Electric Transients

By C. E. Magnusson. Second edition. New York: McGraw-Hill Book Company. 234 pages, illustrated.

This is a completely revised edition of a very fine book on electric transients. New oscillograms have been used and each chapter has been revised completely. The illustrations clarify the text and form the basis for fundamental studies of transients. There is no doubt that the new edition will be very welcome as a textbook and as a reference work for transmission engineers who desire to understand the behavior of transients. It is to be hoped that a further revision at a later date will incorporate a chapter dealing with system stability under transient conditions and thus round out a fundamental study which will have many practical applications.

The Religion of an Electrical Engineer

By George D. Shepardson. New York. Fleming H. Revell Company. 186 pages.

At a time when there is so much discussion about the compatibility or incompatibility of science and religion, and when individual beliefs are changing and dogmas being re-examined, this book by an electrical engineer and scientist is particularly timely. Its author was at the time of his recent death the head of the School of Electrical Engineering at the University of Minnesota. The book is constructive, relating how the author, whose religious beliefs were shattered in early life, reconstructed for himself a religion which still embodied the fundamental tenets of the one he had discarded. Most interesting to persons who are swayed chiefly by the materialistic manifestations of life may be the author's logical synthesis of a religion which has no conflict with scientific discoveries. Even if parts of the book are not accepted by the critical analyst, its perusal can convey no offense to readers of any faith or creed.

Introduction to Contemporary Physics

By K. K. Darrow. New York: D. Van Nostrand Company. 449 pages, illustrated.

This is a clear, connected account of the phenomena upon which contemporary atomic theories are based, together with a study of the theories themselves. Every engineer and physicist should be interested in the unified treatment of the atom. The properties of ions and electrons, the detachment of electrons from atoms, the deflection of flying charged particles by atoms and the energy relations of impact and radiation are some of the aspects of atomic theory brought out by Dr. Darrow. In addition, the new study of atoms by use of line and band spectra is treated at length.

No electrical engineer today can afford to be ignorant of modern physics and the new discoveries and speculations dealing with atomic energy and atomic behavior. This book is a fine introduction to the new physics for engineers and yet has sufficient depth to impart detailed knowledge. The author has used excellent discretion in choice of material and the book is well written and edited. It can be recommended highly to engineers who desire to understand the atomic approach to energy relations in gaseous conduction and ionization.

Elektrische Festigkeitslehre

By Dr.-Ing. A. Schwaiger. Berlin: Julius Springer. 474 pages, 9 full-page charts, 448 illustrations.

There was a time when the sole function of conductors was to conduct, of insulators to insulate and of condensers to hold charges. The evolution of high-frequency alternating-current operation has made every insulator a dielectric, every piece of equipment a condenser, and has endowed condensers with power factors and phase angles. Painful experience has enabled us to accumulate a vast amount of empirical information about innumerable dielectrics, has shown their performance to involve actions that are apparently complex and thus far rather obscure, and has developed the fact that, even when their individual characteristics are fairly well known, their performance in combination is difficult to predict, especially when complicated shapes are involved.

The book under review represents, as its title indicates, an effort to organize this knowledge, to get at the underlying principles and to put the results into such form as to be of practical use to the designer. The present volume is a second, revised and greatly enlarged edition of a treatise originally prepared during the war and presumably not heretofore readily available to the reader outside of the country of its publication. The theoretical treatment is based on well-known and accepted laws of electrostatics. To facilitate the computation of practical cases, the author makes use of a "utilization factor" of which he has tabulated values for various shapes, and which affords a measure of the strength of the dielectric in a given arrangement as compared with the strength for the same thickness for stated standard conditions.

The transformations used to simplify the mathematical treatment are derived before being applied to specific problems. Particular interest attaches to the author's attempt to subject the conditions of flashover to numerical computation and to work out the influence of surface projections on the strength of insulators and bushings.

In various ways the discussions are fuller than those usually found; for example, in the case of needle and sphere gaps specific mention is made of the zone of uncertainty of spark-over voltage, with a chart to show it—a peculiarity which the user generally has to discover for himself through tedious experience. More than 150 pages are devoted to cables, the insulation of machine and transformer windings, bushings and insulators. The bibliography includes over a hundred references, chiefly to recent German periodical literature. Mention should be made of the good general appearance of the book as to typography, illustrations and paper. G. F. W.

Industrial Safety Organization for Executive and Engineer

By Lewis A. De Blois. New York: McGraw-Hill Book Company, Inc. 328 pages, illustrated.

The safety movement has gained impetus and importance in all American industrial life. It has evolved into a science which deals with men and materials and has emerged from the haphazard stage of opinion to one which can be formulated in definite terms. This book is for executives and engineers and is written by a man who has had much general experience in safety work and detailed experience in the safety organizations of the Du Pont interests.

The first part of the work presents detailed statistics on accidents in this country. In all cases but automobile accidents there has come about a gradual improvement in conditions. Safety work has told. The major part of the book is devoted to the establishment and functioning of a safety organization. Detailed plans are given whereby an industry can consider in detail and adapt to its conditions those principles and systems of organization best suited to its needs. An appendix contains codes, forms and reports of value which help to contribute completeness to an authoritative and well-written book on a most important topic.

Book Notes

Radio: Beam and Broadcast. By A. H. Morse. New York: D. Van Nostrand Company. 192 pages, illustrated. Price, $4.

The evolution of the radio art is traced by the author, mainly through Patent Office records of inventions in use today or their lineal forebears. The last 90 pages of the book are devoted to 21 of the more important patents issued in England and the United States.

Books Received

Engineering Problems. By William G. Raymond, Sherman M. Woodward and Irving H. Pragemen. New York: McGraw-Hill Book Company, Inc. 47 pages, illustrated. Price $1.

Theoretical and Practical Electrical Engineering. Vols. 1 and 2. By Louis Denton Bliss. Washington, D. C.: The Bliss Electrical School, Takoma Park. Vol. 1, 735 pages; Vol. 2, 730 pages. Illustrated.

Notes on the Induction Motor. By H. E. Dance. New York: American Branch Oxford University Press. 152 pages, illustrated. Price, $2.

Elementary Heat and Heat Engineers. By F. G. R. Wilkins. New York: American Branch Oxford University Press. 312 pages, illustrated. Price, $2.50.

Electrical Insulating Materials. By Allan Monkhouse, London: Sir Isaac Pitman & Sons, Ltd. 390 pages, illustrated.

Introduction to Contemporary Physics. By K. K. Darrow. New York: D. Van Nostrand Company. 450 pages, illustrated.

Electric Service Distribution Systems. By H. B. Gear and P. F. Williams. Third edition, revised. New York: D. Van Nostrand Company. 475 pages, illustrated.

A Small Stockholder. By John T. Broderick. Schenectady, N. Y.; Robson & Adee. 127 pages. Price $2.

News of the Industry

Kearny Formally Opened

Five Hundred Leaders in Electrical, Financial and Industrial Circles Throng Great Station

NEARLY five hundred men prominent in the world of finance and industry took part in the inspection trip and attended the luncheon which marked the formal opening of the Kearny generating station of the Public Service Electric & Gas Company of Newark, N. J., on Nov. 9. This was the first day of eleven set apart for public inspection of the thirty-million-dollar power house, of which much has been printed in the ELECTRICAL WORLD. The guests were driven to the Kearny station in Public Service buses.

Among the guests not connected with the electrical industry were Governor A. Harry Moore, United States Senator Edward I. Edwards, Generals Bird W. Spencer and William C. Heppenheimer, Andrew F. McBride, New Jersey Commissioner of Labor, W. G. Besler, chairman of board, Central Railroad of New Jersey; W. H. Truesdale, chairman Delaware, Lackawanna & Western, and M. W. Clement, vice-president Pennsylvania Railroad. J. P. Morgan & Company were represented by Thomas S. Lamont and the Standard Oil Company of New Jersey by C. H. Haupt, chief engineer.

Outstanding figures in the electrical industry included Thomas A. Edison, Gerard Swope, president of the General Electric Company; General Guy E. Tripp, chairman of board, Westinghouse Electric & Manufacturing Company; M. S. Sloan, president of the Brooklyn Edison Company; Samuel T. Bodine, chairman, and Arthur W. Thompson, president of the United Gas Improvement Company: J. H. Pardee, president J. G. White Management Corporation; W. W. Freeman, president Union Gas & Electric Company, Cincinnati; Charles H. Tenney, Dwight P. Robinson and W. S. Barstow.

At the luncheon given by the company at the Robert Treat Hotel, Newark, President Thomas N. McCarter welcomed the visitors.

Governor Moore paid a tribute to the farsightedness and accomplishments of Mr. McCarter and his company, adding that a utility thus serving the public is entitled to a "fair break." Mr. Edison's presence was a source of much gratulation.

Public Service of New Jersey Cuts Rates Voluntarily

The Public Service Electric & Gas Company has filed this week with the Board of Public Utility Commissioners of New Jersey a new tariff of electric rates, to take effect with bills rendered in January, which, it is estimated, will reduce the bills paid by its electric customers by $1,000,000 a year.

Under the new tariff the rate for the first 20 kw.-hr. of energy consumed per month will be 9 cents; for the next 30 kw.-hr., 8 cents; next 700 kw.-hr., 7 cents; next 750 kw.-hr., 6 cents; next 6,000 kw.-hr., 5 cents; next 15,000 kw.-hr., 4 cents, and for all consumption over 22,500 kw.-hr., 3 cents. The minimum charge of $1 per month will be continued. The new tariff provides the third substantial cut in electric rates voluntarily made by the Public Service Company within five years. Previous reductions were made in December, 1922, and May, 1924.

Latest Figures on Political Contests in West

Tabulation of the referendum vote polled in California on Nov. 2 on the proposed constitutional amendment to put the state in the hydro-electric business has proceeded slowly. On Wednesday afternoon of this week, seven days after the election, only 6,140 precincts out of 8,512 were tabulated. These gave: For the amendment, 187,676; against, 452,409.

The complete unofficial vote in Oregon on the similar amendment known as the "housewives' water and power board development measure" is: For the amendment, 35,465; against, 142,-023. This is a shade better than four to one against.

The proposed amendment in Colorado vesting a newly created state commission with complete jurisdiction over all utilities except those municipally owned was beaten even more decisively than appeared last week—four votes to one being recorded against it.

Governor Hunt, opponent of the Colorado River interstate compact, has squeezed through in Arizona, where he ran for a sixth term. Final tabulation of official figures, with 100 votes still excluded owing to the tally sheets having been sealed with the ballots, is: Hunt, 39,988; Clark, 39,655—a majority for Hunt of 333.

Federal Water-Power Act Assailed

Invited Speaker Champions State Rights at Asheville Meeting of Commissioners—Patterson on Holding Companies —Kanneberg Deplores Diverse Laws

PROBLEMS associated with hydro-electric development, railroad and bus transportation and federal and state legislation and control of these agencies were discussed in committee reports or were the subject of addresses made by men prominent in regulatory bodies at the thirty-eighth annual convention of the National Association of Railroad and Utilities Commissioners, held this week on Tuesday to Friday at Asheville, N. C.

A. G. Patterson of the Alabama Public Service Commission in his presidential address said that the tremendous development and expansion now going on in the electric light and power industry challenges the attention not only of regulatory bodies but of the general public as well. Although great holding companies are being or have been formed for the purpose of controlling local operating companies and of coordinating and correlating their activities, it does not appear, he said, that harm will result from such combinations if these processes tend to provide more efficient and economical service and do not undertake to wrest from local authorities the control and regulation of the operating companies. The states should guard with jealous care their rights and authority over operating companies, not only to protect the public but to the end that state authority may not become impotent through lack of assertion.

In a round-table discussion on water power Adolph Kanneberg of the Wisconsin Railroad Commission presented the report of the special committee on his subject, which deplored the waste of water-power resources throughout the country and urged efficient and economical development of the rivers and a practical utilization of the watersheds of these rivers. Basing his utterance on an analysis made by the committee of the laws of every state affecting water power, Mr. Kanneberg said that there was a deplorable laxity of regulatory administration covering the development of water power and that there was virtually no uniformity in such laws as had been enacted.

John H. Small, chairman of the National Rivers and Harbors Congress, made an attack on the federal water-power act, pointing particularly to its projection of the federal government into the domain of the control of the generation of hydro-electric power. He declared that the government may not properly attempt to control water power for any other purpose than to maintain navigation. The great importance of states holding to their rights of jurisdiction over hydro-electric development was stressed.

M. H. Aylesworth, president National Broadcasting Company, outlined the work that is being and will be done by this corporation in broadcasting over the nation the finest entertainment programs available. Other notable speakers were Joseph B. Eastman, chairman of the Interstate Commerce Commission; John J. Esch, also of that commission; Alexander Forward of the American Gas Association and Carl D. Jackson.

The following officers were elected:

President, John F. Shaughnessy, chairman Public Service Commission of Nevada; first vice-president, Henry G. Wells of Massachusetts; second vice-president, Lewis E. Gettle of Wisconsin. James B. Walker, secretary; Clyde S. Bailey, assistant secretary, and John E. Benton, solicitor, were re-elected.

New Franchise Drawn Up in Denver

Public Service Company of Colorado Say Rates Contained Will Save Consumers $350,000 a Year—Ray Palmer Makes His Report to City

PROGRESS is at length being made in the long-drawn-out controversy over renewal of the Denver franchise of the Public Service Company of Colorado. The company recently submitted to the city authorities a proposed franchise including a rate ordinance, standards for electric and gas service and a contract for street lighting. Last week Ray Palmer of New York, the consulting engineer employed by the city, whose investigation will cost the taxpayers $60,000, filed his report.

The previous franchise expired on May 15. Under it the company paid annually to the city a franchise tax of $50,000. This provision has not been made in the new proposal, the company calling attention to this omission in the following words: "Provision for a franchise tax has purposely been omitted, for the reason that we believe it better to give to the consumers the benefit of the amount which has heretofore been paid to the city."

Proposed rates for domestic electric and gas service are incorporated in the new franchise proper. Rates for other classes of service are submitted in a separate document, to be filed with the city clerk in advance of the franchise election. It is provided that rates for service other than domestic may be changed during the life of the franchise "by concurrence of the company and the City Council." The electric rates proposed are based on the Wright demand rate and are considerably lower than the rates now in effect in Denver. The new rates ask 7½ cents per kilowatt-hour for the first 7 kw.-hr. used per room per month, 5 cents for the next 7 kw.-hr. per room and 3 cents for all additional energy used per month, with a net monthly minimum of 90 cents per meter. The present rate is a straight 8 cents net. The new commercial lighting rate is graduated according to consumption, ranging from 7½ cents per kilowatt-hour down to 1.35 cents. The present rate is 8 cents down to 0.35 cent. The company estimates that the new rates submitted to the city, if adopted by the people, will effect a saving to the consumers of approximately $350,000 a year.

CONSULTING ENGINEER'S REPORT

Mr. Palmer, in his report, maintains that the company earned more than $675,495 above 8 per cent net return in its electric department, but only 3.97 per cent net in its gas department. The proposed new electric rates would take up only $220,000 of the present surplus profits, he says, and are therefore too high. He places a valuation of $30,995,767 on the company's property that is used for the supplying of electricity and gas to Denver consumers. Of this $21,174,772 is for the electric division. Company officials do not agree with these valuation totals, believing that the city's engineers have left out of their calculations a number of plants necessary for an uninterrupted supply of service to the city of Denver. The company also says that the city's experts have allowed smaller valuations on certain properties than have been fixed by the federal courts. The company's valuation total, submitted to the city early this year, was $39,515,446, of which $27,762,179 was for the electric division. One important difference in pricing between the two sets of engineers pertains to the Shoshone water rights, which cost the Public Service Company $670,000, which were appraised by the federal court at $500,000 in the Colorado Power Company rate case, and which were valued at only $232,745 by the city's engineers.

The new franchise provides that the company shall co-operate with the city in investigating the economic possibilities of hydro-electric power incident to increased water supply for the city. Should the city develop a plan including the production of hydro-electric power, the company agrees to purchase such power in the largest amount it can market. The price to be paid shall be equal to the cost to the company of supplying power of the same kind by other means.

Vice-president C. N. Stannard of the Public Service Company said: "We want it distinctly understood that the company does not agree with Mr. Palmer's figures. We recognize that he is an engineer of national reputation. We believe him to be honest and efficient and learned in his profession, but we also believe he has made errors in his work of valuation which should not go unchallenged at this time. The city's own experts report that we are earning only $280,571 over an 8 per cent return on their own valuation figures, while the company has offered to reduce its earnings by at least $350,000. This certainly indicates that the company's offer to the city is fair."

On the other hand, Mr. Palmer's fixing of the "going value" at $2,699,854 is not well received by the City Attorney, who says: "It is improper. It is capitalizing the franchise which the company expects to get. The United States Supreme Court held in a Detroit case that when a franchise has expired the people have a right to contract for themselves. They are not bound by any rules. They have a right to get the best bargain they can. They should not be charged for the 'going concern' value which the franchise they give may confer upon the company."

Conferences are now to be held between the engineers representing the city and the company, interested city officials and civic organizations.

Commercial National Section Displays Enthusiasm

The committee meetings held by the Commercial National Section of the National Electric Light Association at the Edgewater Beach Hotel in Chicago on Nov. 3, 4, and 5 evidenced a large measure of enthusiasm and energy due to awakened appreciation of the importance of commercial departments in central-station companies. The domestic load as a prime factor in central-station prosperity was emphasized at these meetings, and general opinion pointed toward the necessity for a revision of domestic rates. Discussion on domestic electric cooking brought out the information that the range report of last May had so revivified the range business that more than 20 per cent of the 500,000 ranges now in use had been put on the lines in 1926. General merchandising came up for consideration, and one committeeman averred that central stations might profitably encourage the development of a wider diversity of appliances.

The fact book of the industrial lighting committee, explaining sales organization, campaigns, advertising and prize contests, will be out about Dec. 1 in an issue of 10,000 copies available to central stations, contractors and manufacturers. The competitive power committee considered ways and means for coping with the competition against central-station service by oil engines and bleeder-type turbines.

Because of the rapid developments and the changes in the methods of handling electric refrigeration business, the committee on this subject outlined for itself a program by which the industry would be kept informed by means of notices mailed out to members of the publication of refrigeration material in the technical press. Promotional rates for the encouragement of domestic business were the subject of wide diversities of opinion. The consensus was that the single-price rate should be banished, that reductions should be in the lower brackets, and that action must be taken soon.

British Parliament to Fight Over Power Bill

One of the main contests in the short session of the British Parliament which has just begun is expected to be over the government's electricity supply bill. Concerning this bill the London correspondent of the New York *Herald-Tribune* telegraphs his paper:

"On the ground that it is a step in the direction of nationalization, the bill faces fierce opposition from a strong section of Conservatives. The bill is aimed primarily not so much toward extending the retail supply of electricity as toward increasing the efficiency of production by linking up the main power stations of this country, which ranks as one of the most backward in the world in electrical development. The government says that its scheme, far from being a step toward nationalization, will avert nationalization, which otherwise would be inevitable in view of the disorganization of the industry."

To Develop Savannah River

Subsidiary of Southeastern Power & Light Company Plans to Generate 120,000 Hp. by 1930

PERMISSION to undertake a hydro-electric power project on the Savannah River, 21 miles above Augusta, Ga., and near Clark's Hill, S. C., to cost $20,000,000 and to be completed in 1930, is sought from the Federal Power Commission by the Savannah River Electric Company, a subsidiary of the Southeastern Power & Light Company. The company's program includes the construction of a dam and power plant on the Savannah River, the construction of high-tension power lines from this plant to Atlanta, Charleston and Macon and interconnection of these lines with those of the Georgia Railway & Power Company and other power companies in the section. The dam is to be of solid concrete, 90 ft. high, with 1,850 ft. of spillway and an over-all length of 3,800 ft. The lake to be created by the dam will cover an area of 35,000 acres, or about 55 square miles, and will back water up the Savannah River for a distance of 32 miles. The plant will ultimately be equipped with four 30,000-hp. units, giving it a total rating of 120,000 hp., which will make it outclass the 108,000-hp. Tallulah Falls plant, the largest hydro development in Georgia.

The Savannah River company says that it is ready to begin construction immediately after the project is sanctioned. Its officers and directors are: Preston S. Arkwright, Atlanta, president; H. M. Atkinson, Atlanta, chairman of the board of directors; S. M. Cooper, Charleston, vice-president; W. H. Wright, of Atlanta, secretary-treasurer, and F. P. Frier, of Greenwood, S. C., member of the board of directors.

Power Board Finds Savannah Application Conflicts

As reported just above, an application for permit has been filed with the Federal Power Commission by the Savannah River Electric Company of Greenwood, S. C., covering a 34,560-hp. project on the Savannah River near Clark's Hill, S. C. This project conflicts with that covered by the preliminary permit granted on Aug. 19 to the Twin Cities Power Company. This permit, however, has not been accepted. The delay in acceptance is thought to be due to certain technicalities which the company hopes to overcome. It is expected that it will be accepted, which would mean that action on the new application will not be considered until the outstanding permit has been disposed of.

That the time has been reached when the pulp resources of Alaska can be used to advantage is indicated by the competition which has developed for water-power rights in that territory. William Randolph Hearst on Nov. 5 filed an application for a preliminary permit in the Tongass National Forest which conflicts with the previous applications of Mark L. Requa and of Thebo, Starr & Anderton. Each of these applicants represents well-financed interests. Incidentally the Hearst application covers a portion of the project of the Alaska Pulp & Paper Company which already is under license.

Permission has been given the Burbank (Cal.) Irrigation District No. 4 to diminish the width of the navigable pass in its dam from 430 ft. to 75 ft. under the condition that it may be widened at any time on order of the Secretary of War.

N.E.L.A. Plans for Next June's Exhibition

Application blanks for space and floor plans for the exhibition to be held June 4 to June 10, 1927, at Atlantic City in conjunction with the fiftieth convention of the National Electric Light Association have been prepared by the exhibition committee of the N. E. L. A. and were mailed out to all class D (manufacturers) members the first week in November. The committee requests that applications be filed at committee headquarters, 29 West Thirty-ninth Street, New York, by Dec. 20, to receive consideration in the allotment of space.

A new feature of the exhibition will be the opening on Saturday, June 4, at 1 o'clock, two days in advance of the official opening of the convention. Reasons for this are that many delegates to the convention arrive in Atlantic City on Saturday and Sunday morning, that a large number of non-convention visitors usually spend the week-end in Atlantic City, that the installation cost to exhibitors completing their exhibits by Saturday noon is far less than when the exhibit is opened on Monday, and that it is felt that the extra time added to the period of the exhibition should prove of real value because it furnishes additional opportunity for discussing the exhibits with delegates.

Hoover Praises Electric Utilities

Secretary of Commerce in Annual Report Dwells on Elimination of Waste Through Growth of Electrification—Industry Has "Displayed Initiative and Genius"

ADVANCE copy of some portions of the annual report which Secretary of Commerce Hoover will make to Congress when it reassembles have been released to the press. One of the topics which the Secretary emphasizes is the elimination of waste, and in this connection, after dwelling upon the accomplishments of the railroads and recapitulating his general recommendations of five years ago, he refers with praise to what has been done along the lines of one of these recommendations—that for enlarged electrification to save fuel and labor. On this point Mr. Hoover says:

"In earlier publications of the department, such as 'Superpower Studies in the Northeastern Section of the United States,' great emphasis was laid upon the possibilities of the elimination of waste which lay in the transformation of the power industry through the discoveries in the science of long-distance transmission and their application by large central generating plants feeding large systems and their interconnection with each other. Such savings lay in the greater economy in power production by saving fuel and labor by the larger central plants, the reduction of the amount of reserve equipment required, a better average load factor, and thus less equipment, through pooling of the daily and seasonal fluctuations, together with wider diversification in use; more security against interruption, better utilization of water power by applying it to base loads while making steam carry the peaks, utilization of secondary power from the seasonal flow of streams to the partial relief of steam, savings in industry by replacement of factory steam plants, the increased day load being supplied by the same generating equipment as night load for cities; the larger application of power in replacement of factory labor, and likewise the economies in the household and farm application of power.

"All of these anticipated values have been realized in an extraordinary degree through the initiative and genius displayed in the electrical industry. The electrical generating capacity in the country has increased from 14,280,000 kw. to 23,840,000 kw. in five years, an increase of 67 per cent. Although 66 per cent of our energy output is from fuel, the development of water power has been most active. Of the total of 8,300,000 water horsepower now developed and connected into the systems, 2,500,000 hp., or 43 per cent, has been set to work in the last five years. The enormous savings that have been made in fuel consumption are indicated by the fact that while the electrical output of fuel-burning central stations increased 67 per cent in five years, the fuel used increased less than 15 per cent. The average consumption of coal or its equivalent by such central electrical generating plants decreased from 3 lb. per kilowatt-hour in 1920 to 2.1 lb. during 1925, a saving at the average rate of 11,500,000 tons per annum. New water power effected a further annual saving equivalent to 3,100,000 tons.

"There has been a large increase in the application of electrical power in manufacturing, and while there has been an increase during this period of between five and six million horsepower used in factory production, there has been no increase in boilers and engines installed within these plants, the increase having been made almost entirely by electrical motors operated through purchased power. There has also been a transformation from direct-connected steam equipment within factories to factory electrical generation for distribution throughout the plants, until at the present moment apparently 70 per cent of factory power is delivered to the machines electrically.

"The application of electrical power to home use has received enormous expansion. The number of homes served

has increased in six years from 5,700,000 to over 15,000,000. The number of farms served is expanding rapidly, and in some states, such as California, farm electrification far exceeds that in any other locality in the world. Owing to the economies brought about through central generation and interconnection and through the advances in electrical science the average price of power throughout the country is now somewhat less than before the war, it being one of the few commodities to be delivered on less than a pre-war basis.

"This transformation, it may be said at once, has increased the productivity of our workmen beyond those of any other country; it contributes to our maintenance of high real wages and to the reduction of human sweat; it relieves the home makers of many irksome tasks and adds immeasurably to home comforts. There is still further promise of great progress in the reduction of fuel consumption in the extension of electrification, particularly in the further replacement of factory steam plants, in the electrification of our large railway terminals and the expansion of household use of power."

Colonel Cooper Describes Proposed Dnieper Plant

Colonel Hugh L. Cooper has recently given out a statement concerning the sixty-million-dollar power plant which the soviet government has announced its intention of building on the Dnieper River under his supervision and in part with American electrical equipment. Colonel Cooper said:

"For the last twenty years the value of these rapids for power has been under consideration. In the past five years the soviet government has spent more than $1,000,000 investigating the power and navigation possibilities of the river. After three months of study at the hands of our experts and after three weeks of examination by myself, I formed the opinion that with certain modifications this project could be built.

"The project requires a dam about half a mile long by 120 ft. high and the ultimate development of about 650,000 hydro-electric horsepower, that will furnish approximately 2,000,000,000 kw.-hr. of energy per annum for use in the industrial centers of the southern territory of the Ukraine, which borders on the Black Sea. The plant will be about 200 miles from the Black Sea and will be capable of delivering power to the seaboards of Odessa and Sebastopol.

"About four and one-half years will be required to complete the works. Three locks will permit navigation of the river for 1,000 miles of its length by freight barges of approximately 2,500 tons capacity. The annual transportation by water would be eventually around 12,000,000 tons of freight, which is about twice the existing tonnage movement on the St. Lawrence River.

"On the power side, if the government credits its investment at the rate of 7 per cent for the money chargeable to power and sets aside a reasonable sum for amortization, the hydro-electric energy will be available in the Ukraine at a price considerably below the average price for hydro-electric energy in the United States."

Colonel Cooper said all Russia now consumed less than 1,000,000,000 kw.-hr. annually and that the power to be produced on the Dnieper would cost an average of 2 4-10 mills per kilowatt-hour at point of generation.

Meter Service Companies Want Commission Control

Executives of twelve New York City meter service companies met last week and appointed a committee to make a survey of the business with the view of bringing it under the control of the Public Service Commission of the state. The meeting was called by Charles L. Eidlitz of the Electrical Board of Trade and S. A. Galverts of the Meter Service Company, and a representative of the commission was present.

The meter service companies undertake to supply the energy for large buildings, making a profit by the differential between the wholesale rate for large users of electricity and the retail rate paid by the individual consumer. They also supply the meters. Unscrupulous firms, it was said at the meeting, set their meters to operate fast so that individuals pay for from 10 to 20 per cent more energy than they actually use. The tenant has no recourse except a court order asking for a test of the meter, and it was said that the expense of this procedure is so great that it is seldom resorted to. Reputable concerns want to end this evil and it was explained that this could be done by the Public Service Commission. A bill is now being prepared to put the business under such control.

St. Louis Company Protests Against Tripling of Taxes

The Union Electric Light & Power Company of St. Louis on Nov. 2 applied to the Missouri Supreme Court at Jefferson City for a writ of certiorari to review the action of the State Board of Equalization in placing a tax assessment against the company's properties. The company seeks to have declared illegal a law passed in 1923 and effective last year which took from local communities and placed with the State Board of Equalization the authority to assess the properties of the 104 electric light companies in the state. The petition charges that the law is not specific as to what property of electric companies shall be assessed locally and what by the state. The law sought by reference only to make the method of assessing railroads applicable to electric companies. Land, buildings and materials continue to be assessed locally under the law, while larger items such as plant are assessed by the state.

In 1924, the first year the law was made to apply to electric companies, the assessments of such companies were increased an average of 50 per cent. The assessment of the Union Electric Light & Power Company was raised from $6,287,986 to $17,451,000, while this year there was an additional increase to $21,227,785. The company declares that the average tax rate of the counties in which it operates, including the city of St. Louis, is $2.35 and that hence the increase represents a raise of $496,000 in its taxes. The Union company in 1925 paid 43 per cent of all taxes paid by electric companies in Missouri.

Swope Talks on Responsibilities of Modern Industries

At the annual dinner of the Associated Business Papers, Inc., and national conference of business paper editors held at the Hotel Astor, New York, on the evening of Nov. 10, with three hundred in attendance, Gerard Swope, president both of the General Electric Company and the National Electrical Manufacturers' Association, spoke on "The Responsibilities of Modern Industries," dwelling on these as they concern, first, the industry itself; second, the public; third, the employee, and last, the shareholder. Mr. Swope praised the business papers for their part as interpreters and counselors in the formulation of high industrial standards.

Donald Kirk David, assistant dean Harvard School of Business Administration, spoke on "Aims and Responsibilities of Education in Merchandising."

Bringing in a New 50,000-Kw. Unit at Trenton Channel

THE fourth of the six 50,000-kw. turbo-generator units to be installed in the Trenton Channel plant of the Detroit Edison Company was turned over for the first time recently. A load of 7,000 kw. was handled by the unit on Oct. 25, which was increased a few days later to 15,000 kw. The fifth 50,000-kw. generating unit will be installed later this year.

Purchases and Mergers

Municipal and Other Plants in Eight States Are Transferred—No Large Deal Reported

PRIVATE ownership again triumphed over municipal ownership in Wisconsin when the people of Fort Atkinson at the general election on Nov. 2 voted in favor of accepting the proposal of the Wisconsin Gas & Electric Company to take over and operate the city's electric and gas properties at a price of $450,000. The issue was hotly contested and the vote very close, 965 persons favoring the measure while 947 opposed it. The company had supplied the city with energy at wholesale. Approval of the purchase has already been given by the Railroad Commission.

The Tennessee Railroad and Public Utilities Commission has been asked to approve the sale of the Ripley municipal light, water and ice plant to J. W. O'Bryan of the National Power & Light Company for $265,000.

Unanimous decision to sell the municipal distribution system of Lombard, Ill., to the Public Service Company of Northern Illinois has been made by the Board of Trustees of that place, which previously purchased its energy in bulk.

The Sadorus (Ill.) Light & Power Company, organized in 1920, has been acquired by the Illinois Public Service Company, the transfer taking place Nov. 1.

The electric light plant at Jasper, Fla., has been bought by the Fitkin interests, which operate several plants in south Georgia and north Florida. Jasper is on a trunk line carrying hydro-electric energy south out of Valdosta, Ga.

The Houston Light & Power Company has purchased the power plant at Humble, Tex., and will hereafter furnish power to that place from its high-tension line, which will be extended from the company's Ship Channel generating station for 20 miles through the Humble oil field.

The People's Light & Power Corporation, controlled and managed by the W. B. Foshay interests, has again extended its territory and on Nov. 15 will take over the Wood River Power Company, serving Bellevue, North Star, Gammett, Ketchum, Mines, Picabo, Carey, Richfield, Cascade and Fairfield, Idaho, and the Adams County Light & Power Company, serving Cambridge, Midvale and Counsel, Idaho. The Wood River company, formerly owned by the Consumers' Public Service Company, was purchased from Baker, Walsh & Company of Chicago, and the Adams County Light & Power Company from a local Idaho concern. The Idaho properties will be consolidated with the People's West Coast Hydro-Electric Corporation. The Foshay interests, through the People's Light & Power Corporation, now control and operate, with these acquisitions, utilities serving 150 cities and towns in ten states.

Application has been made to the Indiana Public Service Commission by the Indiana & Michigan Electric Company of South Bend, Ind., for authority to purchase the Allen County Electric Light & Power Company of Grabill, Ind., for $60,000. Both companies are controlled by the American Gas & Electric Company. Harlan, Leo and Woodburn are also served by the Allen County company.

The merger of the Newport Electric Light & Power Company and the Central New York Power Company of Canastota, N. Y., with the Utica, (N. Y.) Gas & Electric Company was announced in Utica on Nov. 1. The Utica Gas & Electric Company has owned a controlling interest in the two companies for some years. The Newport company has a small hydro-electric plant on East Canada Creek and a transmission line to Trenton Falls N. Y.

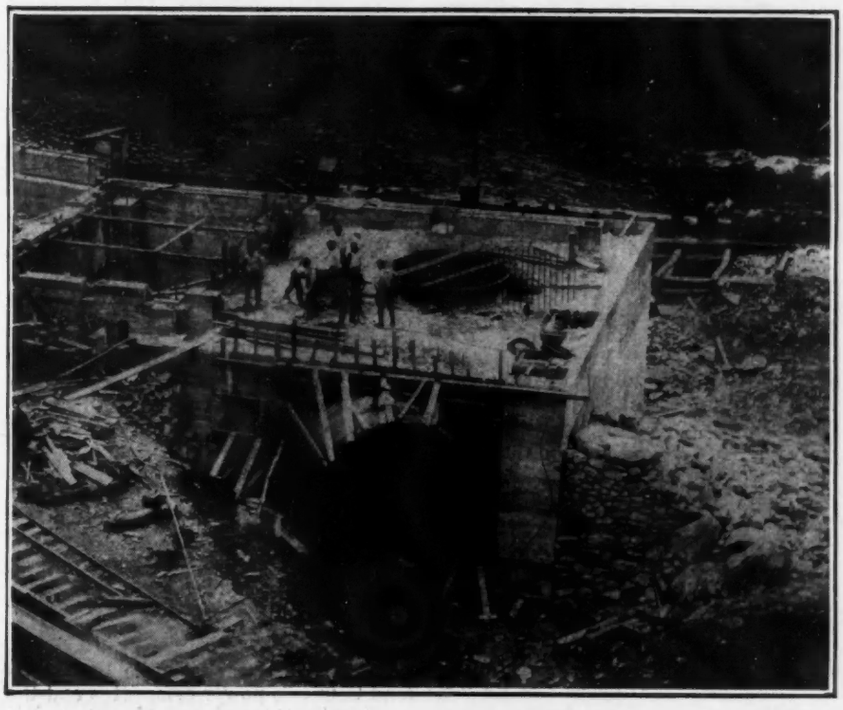
W. E. Wickenden Criticises Engineering Education

Speaking before the fall meeting of the New England Section of the Society for the Promotion of Engineering Education at Worcester recently, W. E. Wickenden, the society's director of investigation, made some pointed criticism of technical education as now conducted. The engineering colleges, he said, provide a most effective form of education for poor and mediocre students, but fail to distinguish sufficiently between the really gifted man and the "superplugger," and their methods do not arouse and develop the initiative of the ablest men and make them ready for a lifetime of self-directed education.

The method now generally adopted, Mr. Wickenden said, "borrowed from industrial management, puts the work load into the form of a sequence of small-dimensioned, planned tasks and tends to limit the student's sense of responsibility to the execution of details and to turn engineering education into an elaborate and efficient scheme of secondary education."

Mr. Wickenden offered four suggestions for improvement of conditions—organization of laboratory squads on a vertical plan, in place of the present horizontal plan; increase in the educative value of examinations, creation of a tutorial division of instruction, in

Sherman Bridge Automatic Plant to Start Soon



THE 7,000-kw. automatic hydro-electric station of the New England Power Company at Sherman Bridge, on the Deerfield River, near the Vermont-Massachusetts boundary, should be in operation by Dec. 15, according to a recent statement by General Manager S. C. Moore, who also declared that the new 110-kv., 100,000-kw. interconnection between the New England and Boston Edison systems is scheduled to be in service by the fall of 1927.

At a recent commission hearing Arthur C. Eaton, hydraulic engineer of the New England company, pointed out that the Sherman development exactly fits into the plan for the complete utilization of the river between station No. 5 above the Hoosac Tunnel east portal and Davis Bridge. Sherman will take the tailwater from Davis Bridge, and its own tailwater will form a part of the headwater supply of No. 5. There is a drop of 78 ft. between the two older plants. This will enable the full capacity of Davis Bridge station, 45,000 kw., to be utilized without spilling water at No. 5 station below. With the full three units operating at Davis Bridge, about 1,800 cu. ft. per second flows through this plant, whereas No. 5 station has a capacity of but 1,000 sec. ft. By filling the Sherman pond during the day water can be backed up for the 2¼ miles between this plant and Davis Bridge sufficiently to equalize the flow and feed it through No. 5 at a rate below the Davis Bridge discharge.

which all students would be required to do part of the work of the last two years, and creation of an honors course for selected students.

Panhandle Plant to Go Into Service Next Week

If expectations are realized, the initial 10,000-kw. installation at Electric City, in the Texas Panhandle, of the generating station of the Panhandle Power & Light Company will go into service next week. The Panhandle company is a subsidiary of the Kansas Power Securities Company, which also owns the Kansas City Power & Light Company. The first unit of this plant to which reference has already been made in these columns, will represent an expenditure of approximately $2,000,000, and to it will be added other units, which will bring the eventual capacity of the plant up to 50,000 hp. and the aggregate cost of construction to approximately $7,500,000, including expenditure for transmission lines throughout the rapidly developing oil field and to Amarillo, Borger, Phillips, Pampa and other towns of the Panhandle. The company already has contracts to supply many of the oil companies with electric power for operating their drilling outfits and other field equipment and camps.

The first plant unit contains two turbo-generator units of 5,000 kw. each with the necessary auxiliaries. Power will be generated at 13,200 volts, and distribution voltage will be stepped up in conformity with standard long-distance practice. The guiding thought in the design, selection of equipment and plant construction, as well as the type of line construction, has been continuity of service. The Panhandle Power & Light Company has franchises to supply electric power and light to Borger, 4 miles away, and other towns of the oil field. It will obtain the water supply for its plant at Electric City by a gravity pipe line from McBride, 15 or 20 miles distant, where a petroleum company is building a waterworks system on a large scale.

Opponents of New River Plant State Objections

A hearing before Major H. M. Trippe at Radford, Va., Oct. 28, in connection with the proposed hydro-electric development on New River by the Appalachian Power Company brought out protests from several interests that fear that they will be damaged by this project. Representatives of the Virginian Railway contended that the proposed dam would interfere with the water supply for its Narrows steam plant. Witnesses for the Norfolk & Western Railway feared that an ice hazard would be created for its bridge over New River. The Electrometallurgical Company requested that any license issued to the Appalachian company safeguard the water supply for its power plant at Kanawha Falls. The State of Virginia also filed objections to the project, and the State of West Virginia, though it failed to send a representative to the hearing, will be allowed to do so. The objections are all largely of a technical nature, and it is thought they can be adjusted. In the meantime the Appalachian company is going ahead with its borings and other investigations. The dam, which it desires to erect at Radford, near the head of the New River, would be 110 ft. high and would form a lake 19 miles long and covering 4,000 acres of land.

The West Virginia Power Company has applied to the Federal Power Commission for a license covering its project on New River just below Bluestone River. The company has completed the investigations under its preliminary permit, issued in 1923. The company proposes to install 125,000 hp.

The West Florida Power Company has applied for a license covering its project on the Ocklocknee River near Jackson's Bluff, Fla. The company plans to install 8,000 hp.

Seattle Prepares for New Steps in Skagit Development

By the action of the Federal Power Commission in granting authority to the city of Seattle to make surveys for three dams between the Canadian border and the present power house and dam at Gorge Creek one of the last formal steps has been taken to permit the city to proceed with the development of the Skagit River project as far as the northern border of Washington. The ultimate development, it is estimated, will cost $55,000,000 and yield between 840,000 hp. and 1,000,000 hp. One of the dams will be midway between the tunnel intake at Gorge Creek and Diablo Canyon, another at Diablo Canyon and a third at Ruby Creek. It will be about 1950, however, before all the Skagit's power will be harnessed, engineers estimate.

Power Problems on Program of Hartford Conference

Power company regulation and interconnection will occupy a prominent place on the program of the second New England Conference, scheduled to be held at the Hotel Bond, Hartford, Conn., Nov. 18 and 19. Since the initial meeting at Worcester last year great interest has been aroused in the relation of interconnection to prosperity in the Northeast, and through the New England Council's power committee and the co-operating members of the public utlities commissions of New England and executives of leading utlility companies a plan for regulation of interstate transmission of energy has been proposed which embodies the co-operation of neighboring commissions instead of federal supervision. This plan will be brought before the conference at Hartford, probably at a session assigned to power matters on the afternoon of Nov. 18.

Gov. J. H. Trumbull of Connecticut will give a complimentary dinner to delegates, guests and organization officials at 7:30 p.m. Nov. 18, at which addresses are scheduled by Governor Trumbull, Governor Ralph O. Brewster of Maine and Owen D. Young, chairman of the board, General Electric Company.

Briefer News

To Celebrate Opening of Richmond-Fredericksburg Line.—The mayors of Richmond, Norfolk and half a dozen other Virginia cities have been invited to help in celebrating the inauguration on Nov. 18 of the Virginia Electric & Power Company's high-tension line from Richmond to Fredericksburg, Va., as have also the Secretary of the Navy and various United States officers. This line, more than 50 miles in length, is expected to prove an unusually important link in the rapidly extending system of the company.

Dates of Next Year's Institute Meetings.—A corrected list of dates for the conventions and regional meetings of the A.I.E.E. in 1927 has been issued from headquarters. The winter convention is scheduled to be held in New York City on Feb. 7-10 and the summer convention at Detroit on June 20-24. Regional meetings will be held as follows: Kansas City, Mo., March 17-18; Bethlehem, Pa., April 14-16; Pittsfield, Mass., May 25-27. The date and time of the Pacific Coast meeting are not yet announced.

Diesel-Electric Ferryboats on the Hudson.—The first electrically operated ferryboats to ply across the Hudson River at New York City went into operation this week, when service began between Twenty-third Street, Manhattan, and Weehawken, N. J. These are the *Governor Moore* and *Charles W. Culkin*, for which Diesel engines generate electric motive power. They are operated by a private company, Electric Ferries, Inc., which hopes to hold its own against the Holland vehicular tunnel now under construction.

Hydro-Electric Scheme for Central Nebraska.—A group of representatives of Nebraska electric power companies will make an early visit to the scene of the proposed Tri-County irrigation project in central Nebraska to estimate its possibilities as a producer of energy. Government aid is being asked by the district, and favorable congressional action is expected at the next session. The project includes the development of two water-power sites in Gosper County and the generation of a large amount of energy, which will be sold under contract.

Cumberland Falls Project in Kentucky May Yield to Opponents.—Because of the organized opposition of scenic beauty associations, the Cumberland Hydro-Electric Power Company is understood to be on the point of withdrawing its application for rights on the Cumberland River in Kentucky. Local feeling, however, is said to resent the outside activities that threaten to deprive the region of more than 100,000 hp. The power company has expended much effort to work out a plan of development which, it asserts, will improve rather than detract from the beauty of the falls, but the company is understood to be ready to abandon

the project rather than insist upon a course which seems to be antagonizing the public in other states, if not in its own.

Dallas-Chicago Air Mail Line to Be Illuminated.—Immediate installation of beacon lights, boundary lights, obstacle lights and other aids to air navigation on the emergency landing fields along the air mail line of the National Air Transport between Dallas and Chicago has been ordered by the Department of Commerce. The landing fields and lights will be about 20 miles apart. The beacon lights will be of the revolving type used on the government air mail line between New York and San Francisco and will have candlepower sufficient to insure their visibility for 45 miles.

Newport Company to Buy Energy.—An agreement has been made by which the Newport (R. I.) Electric Corporation will purchase about 2,500 kw. from the Fall River (Mass.) Electric Light Company through a tie line now being built between the two systems. From the Fall River plant underground lines will be extended to a substation at the state line, whence an overhead, 23-kv. two-circuit line will be erected by the Newport company on a route about 22 miles long to complete the interconnection. Additional energy is available to the Newport company through a tie-in between its plant and the naval torpedo station in that city.

Still Another International Paper Plant for the Ottawa District.—It is reported that the Canadian International Paper Company is planning the development of 40,000 hp. at Mountain Falls on the Red River, which joins the Ottawa River about 50 miles below the city of Ottawa. The company has obtained permission from the Public Service Commission of Quebec to carry out plans to extend further its power and paper activities on the north shore of the Ottawa River, east of the Gatineau, where large power sites are now being developed by it. The plan calls for a dam 120 ft. high and 200 ft. in width.

Rochester Company's Plans for Mount Morris Dam Approved.—The Rochester (N. Y.) Gas & Electric Corporation received word on Nov. 4 from the New York State Engineering Department that its plans for a storage dam in the Genesee River at Mount Morris, to be constructed at an estimated cost of approximately $10,000,000, have been approved and a permit granted for building the structure. The dam is to be constructed by the Mount Morris Light & Power Company, a subsidiary of the Rochester corporation. The actual work will not start for at least a year, however, according to Herman Russell, vice-president and general manager of the latter, and it is probable that it will be still longer, because it is planned to complete the dam now in process of construction at Caneadea before undertaking the Mount Morris project. The Caneadea dam is being built on one of the tributary streams of the Genesee farther up the valley. Both dams are to create storage reservoirs to control the level of the Genesee in the lower valley and provide a more uniform flow throughout the year at Rochester. Eventually it is also planned to develop electric power on a large scale both at Mount Morris and Caneadea.

Public Service Company of Oklahoma to Complete High-Tension Loop.—A complete loop will be formed in the transmission system of the Public Service Company of Oklahoma in the northeast end of the state through construction of a 30,000-volt line extending from Tulsa to Choteau, about 40 miles east. Work on the new line will begin at once. The company already has lines extending northeast from Tulsa to Garnett and Nowata, east to Vinita and Afton and south from Vinita to Adair, Pryor, Choteau and other points. The new loop will enable the towns on the line south of Vinita to secure service from both directions. The line will be supplied largely from the company's West Tulsa plant.

Georgia Voters Approve of Building Flint River Plant.—Another step toward the construction of the proposed 14,000-hp. hydro-electric plant on the Flint River in Crisp County, Ga., near Cordele, was taken last week when the voters of the state carried a constitutional amendment permitting Crisp County to increase its bonded indebtedness beyond 7 per cent for this purpose. The voters of Crisp County itself have now only to vote the bonds required, and there seems no doubt that this will be done although engineers point out that the undertaking is likely to prove a costly one. The first outlay will be be $1,250,000, but much more will, it is predicted, be required before a market can be built up. Under present plans electricity will be sold at 3 cents per kilowatt-hour for lighting and at 5 mills for industrial use.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

Empire State Gas and Electric Association — Electric Meter Section, Hotel Seneca, Rochester, Nov. 15 and 16. C. H. B. Chapin, Grand Central Terminal, New York.

American Welding Society — Buffalo, Nov. 16-19. M. M. Kelly, 29 West 39th Street, New York.

American Society of Agricultural Engineers, Farm Power and Machinery Division—Chicago, Dec. 1 and 2. Raymond Olney, St. Joseph, Mich.

American Society of Mechanical Engineers—New York, Dec. 6-9. C. W. Rice, 29 West 39th St., New York.

National Electrical Credit Association—New York Division, New York, Dec. 7; New England Division, Boston, Jan. 18. F. P. Vose, 1008 Marquette Bldg., Chicago.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 17 and 18. F. D. Weber, Box 745, Portland.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18. F. L. Hutchinson, 36 West 39th St., New York.

Plan Illumination of Highway from Seattle to Tacoma.—A plan which provides for illumination of the new 24-mile highway between Seattle and Tacoma, known as the Seattle-Tacoma Highline, has been submitted by J. D. Ross, superintendent of the city lighting department of Seattle, to the King County Planning Commission. The proposed work would cost $100,000 for concrete light poles, which would be installed 300 ft. apart. Lamps on crossarms would shed a diffused light over the highway, so that automobiles could extinguish their own lights, thus averting accidents caused by glare. Engineers estimate that the plan would cost $5,000 a year for energy and $5,000 annually for maintenance, and it is hoped to have the state finance the project.

Progress of Canada Northern Power Corporation.—The Canada Northern Power Corporation, which controls a group of hydro-electric companies engaged in supplying mining camps in northern Ontario, is making excellent headway, according to a statement issued by A. J. Nesbitt, president of the company. A transmission line is being built from the plant at Indian Chutes into Kirkland Lake, a distance of 28 miles. Good progress is also being made on the new transmission line from the Quinze power plant into the Rouyn mining field of northern Quebec. All the poles are in position and wire has been strung for 43 miles out of the total of 50 miles. It is expected that this line will be completed and in operation by Nov. 15. This line and the one to Kirkland Lake are costing about $750,000. The companies operating under Canadian Northern control are the Northern Canada Power, Northern Ontario Light & Power, Porcupine Power & Light, and Great Northern.

New Gould Street Station in Baltimore Almost Ready.—The 40,000-kw. turbine and condenser in the first section of the new power house of the Consolidated Gas, Electric Light & Power Company at Baltimore are ready for service as soon as steam can be supplied. The work of installing auxiliary equipment is being rapidly completed and testing and "tuning up" is being expedited. This station, which is on Gould Street, on the water front, has two steel stacks which are 140 ft. in height above the boiler-room roof. Another recent addition to the Baltimore company's plant is the architecturally attractive Thirty-fifth Street substation, which provides ample 4,000-volt, 60-cycle feeder facilities to care for future growth besides room for the possible future installation of a 13,200-volt bus structure. Two 6,000-kva., 13,200/4,000-volt, three-phase auto-transformers are installed outdoors along the east wall of the station, concealed from view by the main building and by a curtain wall. The company is also installing at its Custom House Avenue direct-current substation one of the largest synchronous converters built, rated at 17,000 amp. and 250

volts. The rotating element of the machine weighs about 47 tons and is 17 ft. long and 13 ft. in diameter. Its transportation on the railroad and through the streets of Baltimore involved considerable difficulty.

Bryson Plant on Ottawa River May Add 50,000 Hp. to Installation.—A. J. Nesbitt, president of the Ottawa River Power Company, announces that the company has under consideration the installation of two additional units rated at 25,000 hp. each in its plant at Bryson, Quebec. This would increase the installed capacity to 75,000 hp.

New Application for Hydro-Electric Rights on Trinity River, California.—G. C. Specht of Sacramento, Cal., has filed an application with the State Division of Water Rights for the appropriation of 510 sec.-ft. of water from the North Fork of the Trinity River. He proposes to build 11 miles north of Weaverville, Trinity County, a dam of loose-rock construction, 400 ft. high, 1,600 ft. long on the top and 100 ft. at the bottom, which will impound 110,000 acre-ft. of water. There will be a drop of 1,750 ft. through 12 miles of pipe line, and 100,000 theoretical horsepower is involved. Mr. Specht, who is also filing an application with the Federal Power Board, says he represents California capitalists and that a company composed of New Yorkers is expected to buy the power.

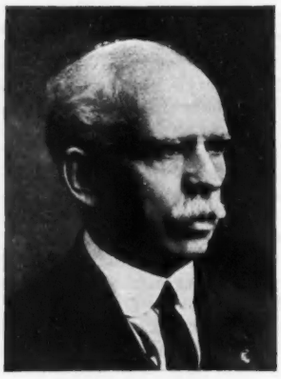
Expansion of Elmira (N. Y.) Central-Station System.—For the coming twelve months the Elmira (N. Y.) Water, Light & Railroad Company has laid out a program of expansion which includes an additional 6,000-kw. turbo-generator in its Riverside power house, a new boiler to burn pulverized fuel and incidental equipment. Some of the existing boilers are also being equipped for pulverized coal. The company intends to build a 110,000-volt, double-circuit, steel-tower transmission line from Elmira for about 68 miles north to connect with lines from Niagara Falls. A 10,000-kw. substation at Elmira is also part of the program, which is to be financed by a two-million-dollar issue of bonds.

To Lease Oswego (N. Y.) Water-Power Rights at Dam 6.—The Common Council of Oswego, N. Y., has finally voted unanimously in favor of entering into a contract with private interests for the development of the city's water power, estimated at 7,500 hp., at the west end of Dam 6 in the Oswego River, the term of the lease not to exceed 25 years. The proposal will be submitted to the taxpayers at a special election. The Carlisle interests, as already reported, have offered an annual rental of $50,000 and have agreed to build a plant costing about $850,000, this plant to revert to the city. The Carlisle interests are promoting an industrial enterprise which, they say, could use the 7,500 hp. in addition to the output of the Oswego River Power Corporation's hydro plant on the Varick Canal. This plant is now nearing completion. Legislation at Albany will be necessary to permit the city to lease its power rights.

Men of the Industry

J. B. Smith Manager of Insull Properties in New Hampshire

J. Brodie Smith, whose appointment as vice-president and general manager of the Public Service Company of New Hampshire, was noted in our columns last week, is one of the best known public utility executives in New England. He was born at Richville, N. Y., in 1861 and when but seventeen years of age built a telegraph line between two New York villages. His early manhood was spent in the drug business at Manchester, N. H., but in 1885 he was able to gratify a desire of many years to enter the electrical field, being appointed superintendent of the municipal fire-alarm telegraph system at Manchester. In 1886 he was appointed superintendent



J. B. SMITH

of the newly organized Ben Franklin Electric Company of Manchester, and upon its consolidation with the Manchester Electric Light Company Mr. Smith was named superintendent and director of the expanded organization. In 1896 he resigned and spent several months in Europe and upon his return was appointed general manager of the company.

In 1900 Mr. Smith became general manager of the Manchester Traction, Light & Power Company, and five years later he received also the title of vice-president. This company, with four others mentioned in last week's issue, was taken over Nov. 1 by the newly formed Insull property (the Public Service Company of New Hampshire), and the merged utilities will be managed by Mr. Smith under the new title. Mr. Smith is actively identified with many civic and fraternal organizations and is as highly regarded in the electric railway field as in central-station circles.

Joseph G. Forsthove, district manager of the Illinois Power & Light Corporation at Quincy, Ill., has resigned to become manager of the public utility properties at Kewanee.

George Newsome, formerly connected with the distribution engineering department of the Consumers Power Company at Jackson, Mich., has been transferred to the Alma district. Other changes in personnel at the Jackson office include the transfer of H. K. Bidwell of the distribution engineering department to the Pontiac district and that of J. C. Howard of the electrical engineering department to the construction department.

R. V. Bingay, president of the Pittsburgh Transformer Company, has been elected to the board of directors of the Monongahela National Bank, one of the largest commercial banks of Pittsburgh.

Frederic E. Bronson of the Bronson Company, Ottawa, Canada, has been elected a director of the Ottawa & Hull Power Company, Ltd., in succession to the late Sir Henry Egan.

R. A. Manwaring, formerly with Dwight P. Robinson & Company, has resigned to become secretary and treasurer of the Philadelphia Electrical & Manufacturing Company. Mr. Manwaring will suceed C. L. Bundy, who has held this position since 1906.

Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, was appointed a vice-president of the New York Electrical League at a meeting of the board of directors held Nov. 3. Mr. Whitehorne is well known to the electrical industry not only in the capacity of editor but also as counselor to electrical manufacturers, electrical jobbers and electric light and power companies on sales promotion programs.

Newell A. Clark, for the past five years general superintendent of the Fall Mountain Electric Company, Bellows Falls, Vt., has been appointed manager of the company, succeeding the late L. J. Royce. Mr. Clark was formerly employed in the Pittsfield Works of the General Electric Company. The Fall Mountain company is affiliated with the New England Power Association.

A. H. Jaeger, who was formerly connected with the Edison Electric Appliance Company in the capacity of manager of the appliance division, has been elected secretary of the Leonard Refrigerator Company, Grand Rapids, Mich. After spending four years with the Edison appliance organization, Mr. Jaeger joined the Leonard Refrigerator Company as assistant sales manager about a year ago, being later made sales manager, which office he retains with the secretaryship of the company.

Noel F. Harrison, formerly of Winnipeg, Manitoba, has removed to Bri Cualann, County Wicklow, Ireland, where he will establish a general engineering practice in design, supervision, investigation and reports. Some time ago Mr. Harrison was assistant to the late R. J. Parke, consulting engineer of Toronto, prior to transferring his interests to Western Canada, where he served with the Canadian Northern Railway Company, the Manitoba Power Commission and the Manitoba Power Company.

Irwin L. Moore, for the past fourteen months assistant to Samuel C. Moore, general manager of the New England Power System, has severed his connection with that organization to join the International Paper Company at New

York as assistant to Archibald R. Graustein, president. He has had abundant experience in electrical and chemical engineering and administrative work. A graduate of Cornell University and of the Massachusetts Institute of Technology, Mr. Moore was identified with the Bureau of Standards at Washington and with the Aluminum Company of America before joining the engineering staff of the New England Power.

R. D. Morrison, of Venice, Ill., has been appointed manager of the Quincy division of the Illinois Power & Light Corporation to succeed Joseph G. Forsthove, resigned.

John F. Vaughan, consulting engineer, Boston, has been appointed chairman of the Hydraulic Power Bureau of the Engineering Section, New England Division of the National Electric Light Association, succeeding W. D. Henderson, resigned.

L. C. Rohret, formerly connected with the Illinois Power & Light Company, is now affiliated with the engineering department of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., in the capacity of assistant engineer.

Matthew S. Sloan, president of the Brooklyn Edison Company and chairman of the Public Relations Section of the National Electric Light Association, has been elected a director of the National Security League, according to an announcement made by General R. L. Bullard, president.

Everett E. Baxter, formerly manager of the Central Iowa Power & Light Company at Charles City, has been made vice-president of the company, with headquarters at Sioux City, Iowa. Mr. Baxter has been with the company for fifteen years, becoming manager at Charles City last February, following a connection at Le Mars.

W. J. McElroy, who has been superintendent of the Ottumwa (Iowa) gas plant for the past three and a half years, has been transferred to Davenport by the United Light & Power Company and has been assigned to the engineering and construction division of the corporation. Before going to Ottumwa Mr. McElroy had been with the People's Light Company in Davenport since 1911.

Lester S. Ready, chief engineer of the California Railroad Commission, has resigned that position, effective Dec. 15, to accept the presidency of the Key System Transit Company, operating an extensive ferry system on San Francisco Bay and a large street-railway system in Oakland, Berkeley and Alameda, Cal. Mr. Ready is a graduate mechanical engineer of the University of California in the class of 1912. After a year in the distribution department of the Pacific Gas & Electric Company he joined the engineering staff of the California Railroad Commission. In 1919 he was made assistant chief engineer and in 1923 chief engineer. **A. G. Mott,** who has acted as transportation engineer under Mr. Ready for the past three years, has been appointed chief engineer. **A. V. Guillou,** who has been gas and electric engineer of the commission, has been made assistant chief engineer.

F. W. Funk Succeeds G. A. Iler

Frank W. Funk, assistant to C. S. MacCalla, general manager of the Pennsylvania-Ohio Power & Light Company and associate companies of the Penn-Ohio System, with main offices in Youngstown, has in addition been appointed chief electrical engineer of the Penn-Ohio to fill the vacancy caused by the resignation of George A. Iler. Mr. Iler severed his connection with the Penn-Ohio service to devote his time to personal commercial interests. He will give special attention to the development of his test stick, high-tension clamp and other electrical devices on which he holds patents.

Mr. Funk first joined the Penn-Ohio organization as electrical engineer early in 1914 and continued in that capacity for three years, when he was appointed resident engineer for the Republic Engineers, Inc. Two years later, with C. I. Crippen, he formed the firm of Crippen & Funk, consulting engineers, and continued in that work till his return to Penn-Ohio a year ago in the capacity of assistant to the general manager. He was graduated from Ohio State University in 1908 and joined the engineering forces of the West Penn Power Company at Connellsville and later the development staff of the Westinghouse Electric & Manufacturing Company. In 1912 he returned to the utility field as assistant electrical engineer of the Northern Ohio Traction & Light Company, where he participated in the design and construction of the Gorge power station. He continued with that company until he removed to Youngstown in 1914. Mr. Funk will be in charge of electrical engineering, construction, operation and maintenance in addition to his duties as assistant to the general manager.

Mr. Iler's resignation terminates a connection with the Penn-Ohio Power & Light Company which dates back to 1923, when he became electrical engineer of the system at Youngstown after serving as radio engineer for the Atlanta (Ga.) *Journal.* Mr. Iler has been prominent in the field of radio engineering, having been radio engineer with the Westinghouse Electric & Manufacturing Company several years before he constructed and operated the big broadcasting plant of the Atlanta *Journal.* At the time of his resignation Mr. Iler had jurisdiction over all electrical matters regarding operation, including metering, construction and engineering.

Ivan Lamphier, formerly connected with the General Electric Company at Schenectady, N. Y., has become superintendent of a power plant at Springfield, Ohio. Mr. Lamphier is a graduate of the University of Michigan.

Walter Blue of Montreal, who has had charge of the engineering work in connection with logging operations for the International Paper Company, has received the important appointment to be manager of the development department of the Gatineau Power Company.

W. Gerald Holmes, director of the manufactures and new industries bureau of the Indianapolis Chamber of Commerce, has resigned his position to become industrial agent for the Interstate Public Service Company of Indianapolis. In his new position Mr. Holmes fills the vacancy caused by the death some weeks ago of Anderson G. Moore of New Albany, Ind., who had been industrial agent for the company for fifteen years.

Albert Kohler, formerly connected with the Arkansas-Missouri Power Company at Walnut Ridge, Ark., as district superintendent, is now identified with the York (Pa.) Railway Company.

H. D. Valentine, formerly connected with the People's Gas Light & Coke Company, Chicago, has been appointed assistant general commercial manager of the Central Hudson Gas & Electric Company system, Poughkeepsie, N. Y. Mr. Valentine will have direct supervision of the sales promotional activities — merchandising, home service, trade promotion, lighting service and rural development.

Obituary

Emil Newman, who engaged in engineering work for the San Joaquin Light & Power Corporation, Fresno, Cal., for more than twenty years, died near Azusa, Cal., on Oct. 3. For the last few years Mr. Newman had served in a consultant capacity.

Oskar Arke, one of the pioneers of the electric porcelain industry in Germany, recently died. From 1892 to 1912 he was head of a Hermsdorf (Thuringia) porcelain factory. Owing to ill health he was forced to retire in the last-mentioned year, but he continued to devote much study to the question of porcelain for insulating purposes in high-tension transmission.

Leland J. Royce, manager of the Fall Mountain Electric Company, Bellows Falls, Vt., died suddenly at his home in that city Oct. 18. In 1887 Mr. Royce entered the employ of the Bellows Falls Canal Company, of which organization he was manager at the time of his death. During nearly 40 years of service he advanced to positions of increasing responsibility, finally being intrusted with the management of both the canal and the electric company. When these companies were taken over by the New England Power System in the fall of 1912 Mr. Royce continued in this executive position. He was 70 years of age.

G. A. Sacchi, manager of the stoker sales department of the Westinghouse Electric & Manufacturing Company, died Nov. 4. Born in New York State, where he received his early school training, Mr. Sacchi spent his entire business career with the Westinghouse organization. In 1909 he became actively engaged in the sale of stokers in the New York territory and later in the sale of large turbines as well. He was appointed district manager of stoker sales, New York, in 1912 and subsequently manager of stoker sales for the entire company with headquarters at East Pittsburgh and later at South Philadelphia. In April, 1926, Mr. Sacchi was elected president of the Stoker Manufacturers' Association, which office he held at the time of his death.

Commission Rulings

Security Issues, Unsound Practices and Overcapitalization. — Denying a petition from the Clyde River Power Company for authority to issue securities, the Vermont Public Service Commission said that permission could not be given to issue preferred stock to cover cash subscriptions and conversion of notes into stock, nor to issue bonds for refunding and to pay debts, where the result would be an excess of securities over sound assets, the deficit being occasioned by unsound practices, extravagance and lack of adequate administrative control. The statutory authority had for its intent the prevention of overcapitalization, and the authorization of securities only when required for the proper development of business promotive of the general good of the public.

Wisconsin Commission Makes Comprehensive Interpretation of "Navigable Stream."—In denying the application of the Nekoosa-Edwards Paper Company of Wisconsin Rapids to build a dam at Four-Mile Creek because of failure to comply with the state's recapture clause, the Railroad Commission of Wisconsin set forth what appears to be a new interpretation of the legal definition of a navigable stream. In this case the commission held that the recapture clause applies to certain small streams which theretofore had been classed as non-navigable. Testimony at the hearing showed that Four-Mile Creek is from 1 ft. to 2 ft. in depth, is crooked and obstructed by fallen timber, but that it can float a canoe. The commission's decision in holding that this is a navigable stream is the first of its kind since the Legislature placed restrictions upon the building of mill dams in 1911. Formerly the commission's jurisdiction over such dams was limited to the approval or rejection of the structure itself. An appeal from the decision is likely. A test case of the validity of Wisconsin's recapture clause is now pending before the United States Supreme Court.

Light and Power Company Ordered to Pay Cost of Installing Inclosed Switches.—The Maryland Public Service Commission, refusing to modify a previous order to the Consolidated Gas, Electric Light & Power Company requiring it to install at its own expense inclosed electric switches on customers' premises, said: "The inclosed switches were not adopted at the request of the customers, nor were they adopted on account of any benefits that might inure therefrom to the customers. It is doubtful, in the opinion of the commission, that when they were adopted any possible resulting benefits to the customers were given more than passing consideration. The main purpose in using inclosed switches was to afford protection to the company against theft of current. Indications are that the purpose was accomplished. Certainly the loss of current by such unauthorized use has been so reduced that the amount now being diverted is almost negligible. Now the company, after having had the protection of inclosed switches for several years, and when it is assured of future protection by reason of the action of the city of Baltimore and the Board of Fire Underwriters, seeks to have the cost of that protection transferred from it to its customers." The commission went on to express its conviction that the burden was properly placed, and that in view of all the circumstances it would be unfair to permit this burden to be shifted to the customers.

Municipal Plant Temporarily Financed Through Company Organized by Citizens Not Taxable.—The Illinois Commerce Commission has ruled that the village of Minier, Ill., cannot assess the lighting plant in that town, its ruling coinciding with findings of the board of review in questions of the same nature presented to it at a tax hearing. The stockholders of the Minier Electric Light & Power Company are all citizens of the village who a few years ago took over the plant when the village was not able to finance it. The company has been operating it under a franchise agreement whereby all profits, after 6 per cent is paid to the stockholders, go into a sinking fund, the agreement being that when this fund shall be sufficient to repay the subscribers to the emergency fund the plant shall revert to the city. There is now $10,000 in this fund, and the board of review was called upon to decide whether or not this money was taxable. The board declared it was not, inasmuch as it was a special fund carried in the city treasury for use of the village. Since the money is not sufficient to comply with terms of the agreement, the village cannot, however, take back the plant at this time and the operating company will continue in charge.

Recent Court Decisions

Power Company Liable for Electrocution of Consumer Regardless of Whether Latter Owned Lines.—Suit was brought, in Mitchell's Administratrix vs. Appalachian Power Company, for damages because of the death (by contact with a guy wire accidentally charged with 2,300 volts) of the manager of an institution owning a pumphouse which was supplied with energy by the company. The company appealed from a verdict against it, asserting (1) that the line was wholly on the property of the plaintiff, (2) that it was not built under direction of the company nor was it the company's property, (3) that a contract for power between the institute and the company absolved the latter from the liability alleged, (4) that employees of the institute had moved the guy wire, thus rendering it unsafe, without necessity for so doing and presumably at the instance of the decedent. The Virginia Supreme Court of Appeals sustained a judgment for the plaintiff, overruling or dissenting from the defendant's claims and declaring: "It seems to us, upon the question of the negligence of the company, that the actual ownership of the line is a matter of little consequence under these circumstances, because to transmit such a deadly current of electricity over such carelessly constructed and unprotected wires is primary negligence on the part of the company, and this whether it owned or controlled the wires or not. It may be true that the institute is also chargeable with negligence, but that cannot relieve the company unless it was free from negligence, because joint tort-feasors are equally liable. . . . Even if the company had succeeded in showing that the negligence of the institute was more culpable than its own negligence, this could not change the result. . . . The company was at least a licensee and as responsible for negligent construction of which it had notice and failure of maintenance which it had assumed as if it had been the absolute owner of the right-of-way and line." (134 S.E. 558.)*

Litigants Before Public Service Commission Entitled to Consider Case Ended When Exceptions Are Not Taken.—Declaring that litigants are entitled to know when the end of a contention is reached and that if no exceptions are taken to the decision of the Public Utilities Commission the utility company concerned may confidently assume the contention to be ended, the Supreme Judicial Court of Maine refused to permit a decree of certiorari sought by A. M. Devereux because of alleged errors of law in a decision by the Public Utilities Commission of Maine. The complainant, the court said, should have sought redress by taking exceptions to the decision for certification to the chief justice of the court. (134 At. 545.)

Water-Power Value and Market Value of Riverbank Land.—The United States Supreme Court on Nov. 1 refused to grant a writ of certiorari sought by the Ford Hydro-Electric Company to have a decision of the Circuit Court of Appeals (see ELECTRICAL WORLD for Nov. 6, page 986) in favor of Janet Neely and others reviewed. The case involved the price to be paid by the company for a strip of land 2 miles long on the Menominee River, in Wisconsin, needed by the company for a power basin. The owners appealed from an award by a commission under the state law. The company objected to the testimony of two witnesses during the hearing in the federal court on the ground that they testified regarding water-power values of the land instead of its market value in its condition of existing ownership and considered the lands as part of a united whole suitable for water-power development. The Circuit Court of Appeals refused to reverse the verdict and this decision stands. In an effort to escape paying the sum asked for flowage rights the Fords had incorporated a public utility in Wisconsin to get the power of condemnation granted to public utilities under the Wisconsin law.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Market Increasingly Firm

Interest Shifts from Other Issues to Utilities After Strong Week in All Markets

THE close of the week ended Wednesday in the stock markets was characterized by a certain amount of caution in the industrial lists and a tendency to turn attention to the public utility and especially the power and light issues. For six successive days gains exceeded losses in the big market. Under the sustained leadership of Motors and Steel many substantial advances were made and there were few recessions of any great consequence. Lower-priced utility stocks were the subject of special interest.

Among the common stocks the week marked a slight advance all around. Brooklyn Edison gained more than five points to 162. Middle West Utilities scored an advance of nearly four points to 114. Public Service of New Jersey rose to 32½ from 32 a week ago and two weeks ago. Other gains were made by American Gas & Electric, Northeastern Power, Philadelphia Electric and several others.

Preferred issues moved in the same direction, although there were few outstanding gains. There was a general marginal advance in prices, especially of the low-priced stocks.

Virginia Electric to Take Over Norfolk Utility

Plans have been formulated for the merger of the Norfolk Railway & Light Company with the Virginia Electric & Power Company, a deal which will involve more than $2,200,000. Properties of the Norfolk Railway are now operated by the Virginia Electric & Power Company under a 99-year lease, but it has been decided that the interests of both companies can better be served by a complete merger of the properties.

The Virginia Electric & Power offers to acquire shares of the Norfolk company either through a straight cash payment or by exchange for preferred stock of the Virginia company. Stockholders of the Norfolk company are offered $33 in cash for each share of capital stock or one share of 6 per cent cumulative preferred stock of the Virginia and $9 in cash for each unit of three shares of capital stock of the Norfolk company.

Montreal Companies Undergo Financial Changes

Predictions that the current year would see important developments in the hydro-electric and public utility fields in the Province of Quebec have already been justified. The first important development of the kind was the split of Montreal Light, Heat & Power Consolidated shares. Then, in addition to the decision of the Quebec Power directors to increase the capitalization of the company and redeem the preferred shares, there were two other developments of relatively minor importance which mark further progress in the cleaning up of the Montreal Tramways & Power situation.

The Montreal Tramways & Power is an English company. As a result it is obvious that United Securities, which company owns 98 per cent of Tram Power stock, has been hampered in its efforts to bring order out of the chaos which existed when the company was taken over. As a result, at a meeting of the Montreal Tramways & Power board Nov. 2, it was decided to take steps before the English courts for the liquidation of the company. It is expected that its assets will be purchased by a new Canadian company, 98 per cent of the stock of which will be held by United Securities. The process of liquidation will probably take several months. Once this is out of the way, United Securities will be able to proceed with financing for reimbursement on account of money already spent and for other corporate purposes. The Montreal Hydro-Electric board also met on Nov. 2, and it was decided to call the $200,000 in bonds of this company outstanding at 105, this being another step in the unraveling of the Tram Power tangle.

Penn-Ohio Edison Structure Simplified

Large Utility Group Almost Completely Rebuilt in Process of Realignment of Subsidiary Companies—Interstate Business Causes Complications in Adjustment

By R. P. Stevens
President Republic Railway & Light Company

BARRING a few details which require some adjustment, the new capital set-up of the Penn-Ohio Edison Company is complete. Less than two years ago the organization had one of the most involved of holding-company structures. Today the various subsidiaries are grouped in orderly fashion on the basis of function. Many of the smaller units have been merged and the company relationships are all clearly defined.

Eighteen months ago the Republic Railway & Light Company, then the parent, directly controlled Penn-Ohio Edison. The latter company controlled seven chief subsidiaries, three of which in turn held control of a diversified group. The Pennsylvania-Ohio Electric Company had forty-two subsidiaries; the Pennsylvania-Ohio Power & Light had nine; the Pittsburgh District Electric Company had three. The total system comprised 64 companies.

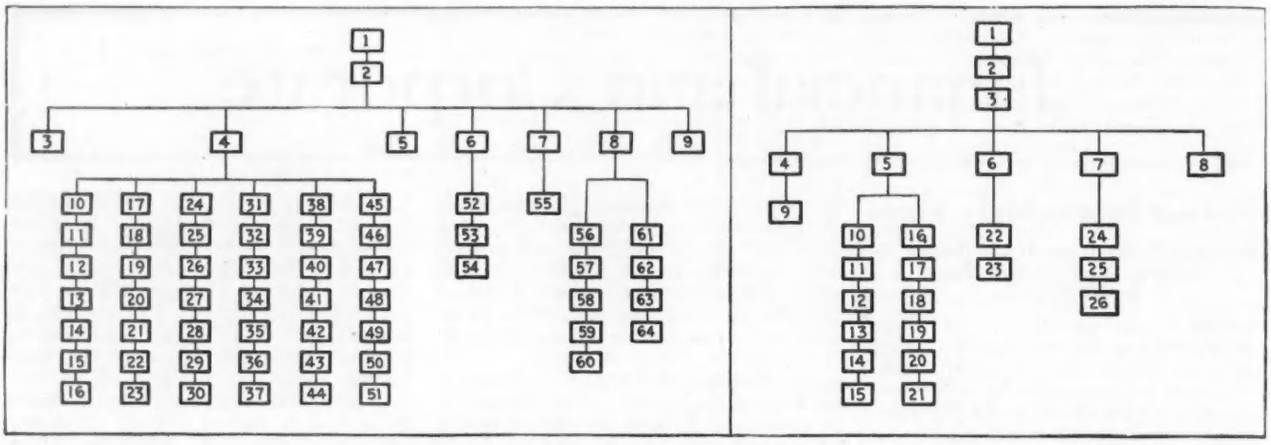
This complicated corporate structure arose from two factors. Like most of our large operating systems of today, the Republic properties represented an aggregation of small units purchased from time to time. In some cases these were consolidated. In others, for various reasons, they remained as separate corporate entities. Very few of this large family were created for the public sale of securities. Out of the 64 only nine had bonds or stock outstanding in the hands of the public.

Unlike many of the large holding companies of today, the Republic system was and is a geographical unity. Although its territory straddles the state boundary of Pennsylvania and Ohio, which had much bearing on the retention as units of these various corporate entities, Pennsylvania-Ohio Power & Light operated chiefly in Ohio, though it had acquired two electric properties in Pennsylvania which were maintained as separate subsidiaries to facilitate relations with the public service commissions of the two states. Similarly Pennsylvania-Ohio Electric possesses electric railway and motor-bus properties operating in both states. Several separate subsidiaries proved essential to the operation of this business. Thirty of the Pennsylvania-Ohio Electric Company's subsidiaries were formed as a temporary expedient to comply with the very difficult laws under which the State of Pennsylvania permits the extension of electric business into new territory. It was not intended, however, that these should operate individually for any great length of time.

Simplification Plans Difficult

When the plans for simplification had been matured, they called for the regrouping of the system under four main subsidiaries directly controlled by the Penn-Ohio Edison Company. The Pennsylvania-Ohio Power & Light Company was to possess the electric properties in Ohio and the Pennsylvania Power Company those in Pennsylvania. The Ohio River Edison Company was to own the new power properties in order to retain a first mortgage position for financing purposes. The railway and bus properties, with one or two exceptions, were to be grouped under a single transportation holding company, which at present is known as the Pennsylvania-Ohio Electric Company.

For the most part these plans have been completed. Today the Penn-Ohio Edison Company directly controls the four main operating subsidiaries as already outlined. The Ohio River Edison Company now has one subsidiary, a



OLD COMPLICATED CAPITAL STRUCTURE OF REPUBLIC RAILWAY & LIGHT

Following are the names of the 64 subsidiary companies existing before the company undertook simplification. In the third column are names of existing companies which will be headed by Penn-Ohio Edison. Companies 1 and 2 will disappear under present plans. The second half of the chart represents the situation at a recent date.

1 Republic Railway & Light Company.
2 Penn-Ohio Edison Company.
3 Zelienople Light & Power Company.
4 Pennsylvania-Ohio Electric Company.
5 Salem Lighting Company.
6 Pittsburgh District Electric Company.
7 Ohio River Edison Company.
8 Pennsylvania-Ohio Power & Light Company.
9 East Ohio Power & Light Company.
10 East End Traction Company.
11 West End Traction Company.
12-16 Five township lighting companies (Pa.).
17-38 Twenty-two township lighting companies (Pa.).
39 Beaver-North Sewickley Power Company.
40 Beaver-Franklin Power Company.
41 Lawrence-Wayne Power Company.
42 New Castle & Lowell Realty Company.
43 Youngstown Municipal Railway Company.
44 Pennsylvania & Mahoning Valley Railway Company.
45 Pennsylvania-Ohio Coach Lines.
46 Akron-Youngstown Bus Company.
47 New Castle & Mahoningtown Street Railway Company.
48 New Castle Electric Street Railway
49 New Castle & Lowell Railway Company.
50 New Castle Electric Company.
51 New Castle Traction Company.
52 Mercer County Light, Heat & Power Company.
53 Kinsman Electric Company.
54 Boston Mining Company.
55 Ohio River Transmission Company.
56 Shenango Valley Electric Light Company.
57 Sharon Gas & Water Company.
58 Mahoning County Light Company.
59 Shenango Valley Traction Company.
60 Pennsylvania Power Company.
61 Sharon & New Castle Street Railway
62 Sharon & New Castle Railway Company.
63 North East Coal Company.
64 Idora Park Company.

APPEARANCE AFTER SIMPLIFICATION

1 Penn-Ohio Securities Corporation.
2 Republic Railway & Light Company.
3 Penn-Ohio Edison Company.
4 Ohio River Edison Company.
5 Penn-Ohio Electric Company.
6 Pennsylvania Power Company.
7 Pennsylvania-Ohio Power & Light Co.
8 New Castle & Lowell Realty Company.
9 Ohio River Transmission Company.
10 East End Traction Company.
11 West End Traction Company.
12 Youngstown Municipal Railway.
13 Pennsylvania & Mahoning Valley Railway Company.
14 New Castle & Lowell Railway Company.
15 New Castle Electric Street Railway.
16 Pennsylvania-Ohio Coach Lines.
17 Akron-Youngstown Bus Company.
18 Cleveland & Mahoning Valley Coach Co.
19 H. A. K. Bus Company.
20 Pennsylvania-Ohio Tourist Company.
21 Youngstown Gas Company.
22 Elwood City Hydro-Electric Company.
23 Boston Mining Company.
24 Shenango Valley Traction Company.
25 North East Coal Company.
26 Mahoning County Light Company.

transmission company whose lines connect the new power plant with the main distributing center of the electric system. The Pennsylvania-Ohio Electric Company has transferred all of its electric subsidiaries and now owns only twelve companies instead of 40. Six of these are separate operating railway properties; five are separate operating bus companies, and the other is the Youngstown Gas Company. By maintaining the individual railway and motor-bus companies it is possible more accurately to determine the operating cost of these properties. The Pennsylvania Power Company, the new company into which the many electric properties in Pennsylvania have been merged, owns only two subsidiaries, a coal-mining company and a small hydro-electric company possessing a valuable charter.

The electric properties in Ohio are now all merged into the Pennsylvania-Ohio Power & Light Company, which has only three subsidiaries, a railway company, a steam-heating company and a coal-mining company. The desirability of conducting such operations under an organization separate from that of the electric light and power business will be readily appreciated.

As a result of the work of simplification which has already been accomplished, there remain only 25 companies in the corporate organization represented by the Republic Railway & Light Company and its subsidiaries. Of these, only nine, as stated, have securities in the hands of the public. The only barrier to further simplification is the division of operations between electric railway, steam-heating, coal-mining ownership and similar departmental operations, plus the fact that the properties, while geographically a single operating unit, are under the jurisdiction of two separate state commissions.

Continental Gas & Electric Net Earnings Up

Operating Costs Increasing Less Rapidly than Gross Revenue—Improvement Is 17 per Cent

AN INCREASE of 17 per cent in the net revenue of Continental Gas & Electric and subsidiaries for the year ended Sept. 30 indicates the progress this company is making. It was possible because of the fact that gross revenue increased by 14 per cent and operating costs by only 11 per cent. Gross earnings were $26,045,171 against $22,901,336 and net revenue $11,827,924 against $10,125,370.

This ratio between gross revenue and expenses more or less indicates whether or not a company is making any definite progress. In the case of many companies there is a tendency for costs to mount more rapidly than, or as rapidly as, revenue. Obviously the continuation of such a situation is a danger signal. Savings resulting from interconnection are usually sufficient to produce a more rapid increase in revenue than in costs. Among expenses other than strictly operating costs, taxes increased to $2,099,307 or more than 8 per cent of the company's gross. Maintenance chargeable to operation declined by a small margin.

Interest charges on the various obligations of the company for the year totaled $1,467,315, so that an unusually good showing was made in respect to the number of times interest was earned. Dividends on the company's preferred issues took $1,222,703, leaving a balance available for depreciation, amortization and common dividends of $5,056,904 against $4,007,457 last year, a rise of 26 per cent. The capital set-up of the company is as follows:

First lien 5 per cent bonds, 1912-27	$3,889,400.00
Refunding 6 per cent bonds, 1922-47	5,461,200.00
Collateral trust 7 per cent bonds, 1924-54	1,942,600.00
Secured 6½ per cent bonds, 1924-64	11,700,000.00
Prior preference 7 per cent stock	11,798,900.00
Participating preferred 6-8 per cent stock	5,672,700.00
Common capital stock, no par	178,535½ shares

Continental Gas & Electric Corporation, which is controlled by United Light & Power, receives more than 78 per cent of its net revenue from the sale of electric light and power. Its subsidiaries serve more than 235,000 customers in a total population of about 1,000,000. Such cities as Kansas City, Mo., Columbus, Ohio, Lincoln, Neb., and Brandon, Manitoba, are served with electric light and power. The company

also serves 188 smaller cities and communities in Missouri, Iowa, Nebraska and Ohio. Subsidiary companies include the Canada Gas & Electric Corporation, Havelock (Neb.) Electric Light Company, Iowa Service Company, Maryville (Mo.) Electric Light & Power Company and Nebraska Gas & Electric Company.

New Capital Issues

An additional issue of 6 per cent cumulative preferred stock, 1925 series, of the Public Service Electric & Gas Company, Newark, N. J., was offered during the week ended Nov. 11, the offering representing the largest issue of the week—$15,000,000. The stock was priced at 102¼ and accrued dividend, to yield about 5.87 per cent. The proceeds of this fifteen-million-dollar issue of preferred stock will be used to reimburse the company for expenditures and additions to the property.

During the week under review the Long Island Lighting Company issued additional first refunding mortgage 5 per cent gold bonds to the amount of $2,000,000, the price being 99½ and accrued interest. These series B bonds, dated Sept. 1, 1925, and maturing Sept. 1, 1955, are secured, equally with series A bonds, by a direct mortgage on the entire property of the company now owned or hereafter acquired.

Another recent offer was that made by the People's Light & Power Corporation in the form of convertible 5½ per cent serial gold notes with stock purchase warrants, a piece of financing involving a total of $1,000,000. These notes were dated Nov. 15, 1926, and

Dividends Declared

Name of Company	Per Cent	When Payable
American Electric, pf. A	.43¾	Nov. 15
American Superpower, ptc. pf.	$0.50	Nov. 15
Brooklyn Edison	2	Dec. 1
Cape Breton Electric, pf.	3	Nov. 1
Central Arkansas Ry. & Lt., pf.	1¾	Dec. 1
Charlestown Gas & Electric	$1.25	Nov. 1
Charlestown Gas & Electric, extra	.25	Nov. 1
Cities Service, com.*	‖	Dec. 1
Cities Service, com.†	‖	Dec. 1
Cities Service, pf. and pf. B*	‖	Dec. 1
Cities Service Power & Light, pf.*	.58⅓	Nov. 15
Consolidated Gas of N. Y., com.	$1.25	Dec. 15
Derby Gas & Electric, $7 pf.	$1.75	Oct. 31
Duquesne Light, 1st pf.	1¾	Dec. 15
Electric Powr & Light, 2nd pf.	$1.75	Nov. 1
Federal Light & Traction, com.	.20	Jan. 3
Federal Light & Traction, com.*	.15	Jan. 3
Federal Light & Traction, pf.	1¾	Dec. 1
Foshay, (W. B.) Co., com.*	.67	Nov. 10
Foshay, (W. B.) Co., 7% pf.*	.58	Nov. 10
Foshay, (W. B.) Co., pf. A*	.67	Nov. 10
Illuminating & Power Secur., com.	.45	Nov. 10
Illuminating & Power Secur., pf.	1¾	Nov. 15
Ingersoll-Rand, com.	.75	Dec. 1
Ingersoll-Rand, com. (extra)	$1	Dec. 1
International Combustion Engr.	.50	Nov. 30
Louisville Gas & Elec., (Del.), com. A and B	.43¾	Dec. 25
Montpelier & Barre Lt. & Pwr., com.	.50	Oct. 15
Montpelier & Barre Lt. & Pwr., pf.	1¼	Oct. 15
Montpelier & Barre Lt. & Pwr., 7% pr. pf.	1¾	Oct. 15
Municipal Service, com.	.25	Dec. 1
North American Edison, pf.	1.50	Dec. 1
No. American Utility Secur., 1st pf.	$1.50	Dec. 15
No. American Utility Secur., 1st pf. allot. ctfs.	$1.50	Dec. 15
Peoples Light & Powr, com. A*	.20	Nov. 10
Peoples Light & Power, 7% pf.*	.58	Nov. 10
Philadelphia Sub. Gas & Elec., pf.	$1.75	Nov. 1
Portland Electric Power, 2nd pf.	1¾	Dec. 1
Southern Colorado Power, pf.	1¾	Dec. 15
Southern Canada Power	$1	Nov. 15
Southwestern Power & Light, pf.	1¾	Dec. 1
Standard Power & Light, pf.	1¾	Nov. 1
Tampa Electric	.62	Nov. 15
Timken Roller Bearing, com.	$1	Dec. 4
Timken Roller Bearing, com., extra	.25	Dec. 4
United Electric Light, pf.	1¾	Nov. 15
United Electric Light, com.	$1.25	Nov. 15
Utility Shares, ptc. pf.	.30	Dec. 1
Utility Shares, com.	.50	Dec. 15
Virginia Elec. & Pwr., pf.	$1.75	Dec. 20
White, (J. G.) & Co., pf.	1¾	Dec. 1
White, (J. G.) Engineering, pf.	1¾	Dec. 1
White, (J. G.) Management, pf.	1¾	Dec. 1
Wisconsin Power & Light, pf.	1¾	Dec. 15
Yale & Towne Mfg.	$1	Dec. 1

* Monthly. † Payable in common stock.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 9	Low 1926	High 1926
ABITIBI PWR. & PAPER, com.—no par	92¼	70¼	98
Adirondack Pwr. & Lt.—7% pf.	103	....	....
Adirondack Pwr. & Lt.—8% pf.	112	....	....
Ala. Pwr., pf.	106	....	....
Allis-Chalmers Mfg. pf.	107	105	110¼
Allis-Chalmers Mfg., com.	89¼	78¼	94¼
Aluminum Co. of Amer., com.	68	....	....
Aluminum Co. of Amer. pf.	102¼	96¼	102¼
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	84¼	79	98
Amer. & Foreign Pwr., com.—no par	15¼	14¼	42¼
Amer. Bosch Magneto, com.—no par	17	16	34¼
Amer. Brown Boveri, Elec.	42	30¼	50
Amer. Brown Boveri, Elec., pf.	96¼	86¼	97¼
Amer. Elec. pwr., —50	m47	36	59
Amer. Gas & Elec., 6% pf.—no par	96	90¼	96¼
Amer. Gas & Elec., com.—no par	107¼	64	110¼
Amer. Lt. & Trac., 6% pf.	120¼	105	120¼
Amer. Lt. & Trac., com.	206	193	263
Amer. Pwr. & Lt., 6% pf.	97¼	92	99¼
Amer. Pwr. & Lt., com.—no par	m 66¼	50¼	72
Amer. Pub. Serv., 7% pf.	96	....	....
Amer. Pub. Serv., com.	50	....	....
Amer. Pub. Utilities, 6% pf.	78	....	....
Amer. Pub. Utilities, 7% pf.	91	....	....
Amer. Pub. Utilities, com.	68	....	....
Amer. States Sec., A	2¼	....	....
Amer. States Sec. B	2¼	....	....
Amer. Superpwr., pf.—25	26¼	23	26¾
Amer. Superpower, pf.	95	....	....
Amer. Superpwr., Class A—no par.	29¼	19¼	37¼
Amer. Superpwr., Class B—no par.	30¼	2¼	39
Amer. Wtr. Wks. & Elec., 7% pf.	104	101¼	108¼
Amer. Wtr. Wks. & Elec., com.—20.	55¼	45¼	74
Anaconda Copper	49¼	41¼	51¼
Appalachian Elec. Pwr., 7% pf.	98	....	....
Appalachian Elec. Pwr., 1st pf., 7%.	98	....	....
Appalachian Elec. Pwr., com.	78	....	....
Arizona Pwr., 7% pf.	71	....	....
Arkansas Cent. Pwr., pf., $7—no par	101	....	....
Arkansas Lt. & Pwr., 7% pf.	100	....	....
Arkansas Lt. & Pwr., com.	100	....	....
Asheville Pwr. & Lt., 7% pf.	f107	110¼	107¼
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	83	....	....
Assoc. Gas & Elec., Class A—no par	35	25¼	38¼
BABCOCK & WILCOX, com.	114¼	....	....
Binghamton Lt., Ht. & Pwr., pf.	90	....	....
Birmingham Elec. pf.—$7—no par	105	....	....
Blackstone Valley Gas & Elec., pf.	103	....	....
Blackstone Valley G.&E., com.—50	102	....	....
Blaw-Knox, com.	f 74¼	45	80
Brazilian Trac., Lt. & Pwr., com.	f10?¼	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	162	133	163
Buffalo, Niagara&East.Pwr.,pf.—25.	25	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	29¼	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	....	....
California Ry. & Pwr., pf.	130	....	....
Carolina Pwr. & Lt., pf.—$7—no par	107	....	....
Cent. & S. W. Ut. 7% pf.—no par	a 92	89¼	96¼
Cent. & S. W. Ut., pr. In. pf.—no par	a 99	93	100
Central Ariz. Lt. & Pwr., pf.	98	....	....
Central Ark. Ry. & Lt., 7% pf.	98	....	....
Central Ill. Pub. Serv., 6% pf.	89	....	....
Central Ind. Pwr., 7% pf.	85	....	....
Central Pwr. & Lt., pf.	100	....	....
Central States Elec., 7% pf.	92	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m117	110	117
Chicago Fuse Mfg., com., no par	m 32	30	35
Cincinnati Gas & Elec., com.	g 93¼	....	....
Cities Service, 6% pf.	i 92	86¼	92
Cities Service, pf.B—10	i 8¼	7¼	8¼
Cities Service, pf. BB—100	i 82½	74	82½
Cities Service, com.—20	i 48¾	37¼	48¾
Cities Service, Bks. Shrs.—10	i 24¼	19¼	24¼
Clarion River Pwr., pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	107¼	....	....
Cleveland Elec. Illg., com.	290	....	....
Colorado Pwr., 7% pf.	95	....	....
Columbia Gas & Elec., 7% pf.	113¼	111¼	115½
Columbia Gas & E., com.—no par	86¼	63¼	90
Columbia Ry., Gas & Elec., 6% pf.	90	....	....
Columbus Elec. & Pwr., 2d pf.	104¼	....	....
Columbus Elec. & Pwr., new com.	48	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98¼	....	....
Columbus Ry., Pwr. & Lt., pf. B.	93	....	....
Col. Ry., Pwr. & Lt., com.—no par.	75	....	....
Commonwealth Edison, com.	a136¼	135¼	145
Commonwealth Pwr., 6% pf.	90	82	91
Commonwealth Pwr., com.—no par.	40¼	28¼	48¼
Conn. Lt. & Pwr., 8% pf.	116	....	....
Conn. Lt. & Pwr., 7% pf.	109	....	....
Cons. Gas of N. Y., pf.—50	58¼	....	....
Cons. Gas of N.Y., com.—no par	112¼	87	115¼
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	f105	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e111¼	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e111	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e126¼	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 51¼	45	57¼
Cons. Pwr. & Lt., 7% pf.	104	....	....
Consumers Pwr., 6% pf.	98	....	....
Consumers Pwr., 6.6% pf.	103¼	....	....
Continental Gas & Elec., 7% ptc. pf	103	....	....
Continental Gas & Elec., 7% pr. pf.	97¼	....	....
Continental G.&E., com.—no par	160	....	....
Crocker Wheeler, com.	21	....	....
Crocker Wheeler, pf.	58	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	99¼	....	....
Detroit Edison, com.	134¼	123¼	141¼
Dubilier Condenser com.—no par.	5¼	3¼	11
Dubuque Elec., 6% pf.	94	93	98¼
Duquesne Lt., 7% pf.	115¼	111¼	116¼
EAST, N. Y. UTIL. pf.	100	....	....
Eastern New York Util., com.	65	....	....
Eastern States Power	12	....	....
Eastern States Power, pf.	89	....	....
Eastern Tex. Elec., 7% pf.	102	....	....
East. Tex. Elec., com.—no par.	75	....	....
Edison Elec. Illum. of Boston, com.	d220¼	....	....
E. Paso Elec., com.—no par	70	....	....
E. Paso Elec. pf.	104	....	....
Elec. Bond & Share, 6% pf.	h106	103¼	109¼
E. Bd. & Share Sec., com.—no par.	i 66¼	56¼	86
El. Household Util.	a 11¼	11¼	25
Elec. Investors, 6% pf.—no par	92	....	....
Elec. Investors, com.—no par	37¼	30¼	74¼
Elec. Investors, 10% pd. receipts	25	....	....
Elec. Pwr. & Lt., ctfs. pf.	94	....	....
Elec. Pwr. & Lt., ctfs., 40% pd.	h101¼	99¼	115
Elec. Pwr. & Lt., ctfs. full pd.	h101¼	102	110¼
Elec. Pwr. & Lt., ctfs., com—no par.	16¼	15¼	34¼
Elec. Refrig.	46¼	43¼	78¼
Elec. Ry. Securities, com.—no par.	m 5¼	4¼	10
Elec. Storage Battery, com.—no par.	85¼	71¼	94¼
Elmira Wtr., Lt. & R. R., 7% pf.	98	97¼	99¼
Emerson Elec. pf.	b101	100	104¼
Empire Dist. Elec., 6% pf.	i 90	82	90
Empire Power, A	27	21	32
Engr. Pub. Serv., pf.—no par	m 93	93	96¼
Engr. Pub. Serv., com.—no par	20	19¼	24¼
Eureka Vac. Cleaner, com.—no par	57¼	43	57¼
FAIRBANKS MORSE, pf.	h108	108	115
Fairbanks Morse, com.—no par	k 43¼	40¼	59¼
Federal Lt. & Trac., com.	33¼	28	39¼
Federal Light & Traction, pf.	88	86	91¼
Federal Utilities, pf.	m 70	....	....
Federal Utilities, com.	m 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	i 107¼	105	108¼
GALVESTON-HOUSTON ELEC., 6% pf.	58	....	....
Galveston-Hstn. El., com.	13	....	....
Gen. Elec., com.	85	79	95¼
Gen. Elec., special—10	11¼	11	11¼
Gen. G.&E., (Del.) com. A no par.	39¼	34	59
Gen. G.&E., (Del.) com. B no par.	37¼	36	48¼
Gen. G.&E., (Del.) A pf. $8 no par.	k111	105¼	113
Gen. G.&E., (Del.) A pf. $7 no par.	k 98	95	99¼
Gen. G.&E., (Del.) pf. B	93	92¼	96
General Public Service, pf.	m103	100	106
General Public Service, com.	m 11¼	11¼	16¼
Ga. Lt., Pwr., & Rys., 6% pf.	89	77	97
Ga. Lt., Pwr. & Rys., com.	60	65	80
Ga. Ry. & Power, 8% pf.	114	....	....
Ga. Ry. & Power, 7% pf.	107	....	....
Ga. Ry. & Pwr., 4% pf.	114	....	....
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h102	....	....
IDAHO PWR., 7% pf.	103	....	....
Ill. No. Utilities, 6% pf.	a 91¼	90	92¼
Ill. Pwr. & Lt., 7% pf.	98	....	....
Ingersoll Rand	k 95½	80¼	104
Int. Combus. Engr., com.—no par	k 44¼	33¼	64¼
Int. Utilities, class A—no par.	k 29	25	39
Int. Utilities, class B—no par.	k 4¼	3¼	9¼
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	97	....	....
Iowa Ry. & Lt., 7% pf.	95	....	....
JERSEY CENTRAL PWR. & LT., 7% pf.	96	....	....
Jersey Central Pwr. & Lt., ptc., pf.	108	....	....
Jersey Central Pwr. & Lt., com.—no par	25	....	....
Johns-Manville, com.—no par.	150	130	165

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Saturday, Nov. 6. lBid, low, high, Wednesday, Nov. 10. mLatest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 9	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	k112	107¼	113¼
Kansas Gas & Elec., 7% pf. ex. div.	l103¼	99	103¼
Kentucky Hydro-Elec., pf.	a 93½	91¼	95¼
Kentucky Sec., 6% pf.	k 82	75	85
Kentucky Sec., com.	105	....	....
Kentucky Utilities, 6% pf.	82	90	95
Keystone Pwr. & Lt. 7% pf.	96½	....	....
LA CLEDE GAS LT., com.	k160	146	175½
Lehigh Pwr. Sec., com.—no par	14½	10	22
Long Island Ltg., 7% pf.	108	....	....
Long Island Ltg., com.—no par	130	....	....
Los Angeles Gas & Elec., 6% pf.	99	....	....
Louisville Gas & Elec., Class. A	24½	22¼	26½
MANHATTAN ELEC. SUPPLY.	55	44	87½
Manila Elec., com.—no par	k 43½	27½	45½
Maytag Mfg., com.	23½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	108	....	....
Metro. Edison, pf.—$6—no par	93	....	....
Metropolitan Edison, pf., $7, no par.	104	....	....
Metropolitan Edison, com., no par.	k 55	45	55
Middle West Utilities, 7% pf.	a105½	....	....
Middle West Utilities, 7% pr. lien pf.	a116½	....	....
Middle West Utilities, com.—no par.	a114	....	....
Midland Utilities, pr. In. pf.	a 99	....	....
Midland Utilities pf. A	a 98	....	....
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	97	....	....
Minn. Pwr. & Lt., 7% pf.	l104½	100	104½
Miss. Pwr. & Lt., pf.	105	....	....
Miss. River Pwr., 6% pf.	95	....	....
Miss. River Pwr., com.	m 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7 no par.	103½	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	98	....	....
Mohawk Hudson Pwr., com.—no par	24½	20½	28½
Montana Pwr., pf.	m117½	112½	119½
Montana Pwr., com.	82	69½	83½
Montreal Pwr., com.	f 73½	....	....
Mountain States Pwr. pf.	97	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	97	....	....
National Carbon, pf.	m124	124	128
National Electric Pwr-A.	e 22	19½	26½
National Elec. Pwr., pf.	a 93½	92	96½
Nat. Lt., Ht. & Pwr., com.	24	....	....
National Lt., Ht. & Pwr., 5% pf.	72	....	....
National Pwr. & Lt., pf., $7—no par.	102	96	102½
National Pwr. & Lt., com.—no par.	20	16½	38½
National Pub. Serv., 7% pf.	89	....	....
National Pub. Serv., pfc. pf.	108	....	....
National Pub. Serv., A com.—no par.	k 18½	15½	24
National Pub. Serv., B com.—no par.	14½	10	17½
Nebraska Pwr., 7% pf.	l107½	103	107½
Nevada-Calif., Elec., com.	m 20	18½	44½
New Brunswick Pwr., pf.	55	....	....
New England Pub. Serv., pr. In. pf.	99	....	....
New England Pub. Serv., pf.	92	....	....
N. J. Pwr. & Lt., 7% pf.	109½	....	....
New Orleans Pub. Serv., 7% pf.	103	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	88	....	....
N. Y. Central Elec., 7% pf.	98	....	....
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25	k 28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	109	....	....
No. Amer., 6% pf.—50	k 50	49	52½
No. Amer., com.—10	50	42	67
No. Amer. Edison pf.—no par	94½	91½	96½
No. Amer. Lt. & Pwr., pf.	m101	88	104
No. American Utilities, pf., full pd.	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par	93	....	....
Northeastern Pwr., com.	18½	15½	36½
No. Indiana Gas & Elec., pf. A	101	98	103½
No. Indiana Public Service—pf.	100	....	....
No. N. Y. Utilities, 7% pf.	103	....	....
No. Ohio Pwr., com.—no par	13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	....	....
No. Ohio Trac. & Lt., 7% pf.	92	....	....
No. Ont. Lt. & Pwr., pf.	78	....	....
No. Ont. Lt. & Pwr., com.	73	....	....
No. States Pwr., 7% pf.	102	....	....
No. States Pwr. com.	k105	98½	136½
No. Texas Elec., 6% pf.	50	....	....
No Texas Elec., com.	m 19	....	....
OHIO BRASS, com. B—no par	k 72	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	....	....
Ohio Pwr., 6% pf.	95½	....	....
Ohio Pub. Serv., 6% pf.	i 94½	90	96½
Ohio Pub. Serv., 7% pf.	l102½	96	102½
Ohio River Edison, pf.	101	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	98½	....	....
Pacific Gas & Elec. com.	129½	118	133½
Pacific Pwr. & Lt., 7% pf.	l102½	98	102½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt & Pwr., pf.—no par	c 72	70½	91
Penn-Ohio Edison, 7% pf.	96	....	....
Penn-Ohio Elec., 7% pf.	95	....	....
Penn-Ohio Pwr. & Lt., 7% pf.	98	....	....
Penn-Ohio Pwr., & Lt., 8% pf.	107	....	....
Penn Pwr. & Lt.—$7—no par.	l106½	103	108½
Penn Pub. Serv., 7% pf.	103	96	103
Penn Pub. Serv., 6% pf.	87	85	90
Penn Wtr. & Pwr., com.	e160	141	171
Phila. Co., 6% pf.—50	c 49½	48	50½
Phila. Co., com.—50	k 71	59½	76½
Phila. Elec., com.—25	c 51½	....	....
Pittsburgh Utilities, pf.—10	m 19½	14½	20½
Portland Elec. Pwr., 7% pf.	98	....	....
Portland Elec. Pwr., 6% pf.	83	....	....
Portland Elec. Pwr., 6% 2nd pf.	70	....	....
Portland Elec. Pwr., com.	28	....	....
Potomac Elec. Pwr., pf.	l107½	....	....
Pwr. Corp. of N.Y., com—no par.	m 79	77½	90½
Pwr. Sec., pf.—no par.	24	10	29
Pwr. Sec., com.—no par.	6	4	13
Pub. Serv. of Colorado 7% pf.	l 99	96	100
Pub. Serv. of N. J., 7% pf.	k108½	103½	109½
Pub. Serv. of N. J., 8% pf.	k123½	115	124½
Pub. Serv. of N. J., com.—no par.	32½	31½	32½
Pub. Serv. of No. Ill., 6% pf.	a100	99½	106
Public Serv. of No. Ill., 7% pf.	a113½	....	....
Pub. Serv. of No. Ill., com.—no par	a129	127	140
Pub. Serv. of No. Ill., com.	a130	128	143
Pub. Serv. of Okla., 7% pf.	98	92	97
Pub. Serv. Elec. & Gas, 6% pf.	103½	97	104½
Public Service Elec. Pwr., pf.	k112½	106	114
Puget Sound Pwr. & Lt., 7% pf.	104	....	....
Puget Sound Pwr. & Lt., 6% pf.	83½	....	....
Puget Sound Pwr., & Lt., com.	28	....	....
RADIO CORP. OF AM., pf.—50	50½	44½	50½
Radio Corp. of Amer., com —no par.	60½	32	60½
Republic Ry. & Lt., pf.	115	....	....
Republic Ry. & Lt., com.	93	....	....
Rochester Gas & Elec., 5% pf.	95	80	98
Rochester Gas & Elec., 6% pf.	104	100	103
Rochester Gas & Elec., 7% pf.	104	105	107
SAN JOAQUIN LT. & PWR., 7% pf.	106	97½	98½
Safety Cable, com.	55½	42½	55½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	67	60	70
Servel Corp.	15	12½	22½
Sierra Pacific Elec., com.	23½	....	....
Sioux City Gas & Elec., 7% pf.	99	....	....
S. E. Pwr. & Lt., pf.—$7—no par.	99½	....	....
Southeastern Pwr. & Lt., pfc. pf.	66½	....	....
S. E. Pwr. & Lt., com.—no par.	31½	20	46½
So. Calif. Edison, 8% pf.—25	30	....	....
So. Calif. Edison, 7% pf.—25	27½	....	....
So. Calif. Edison, 6% pf.—25	24½	....	....
So. Calif. Edison, com.	30½	30½	33
Southern Cities Utilities, 7% pf.	86	....	....
Southern Cities Utilities, com.	36½	28	49
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B	60	....	....
Southwestern Lt. & Pwr., $6 pf.	80	....	....
Southwestern Pwr. & Lt., 7% pf.	104	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	97	95	100
Standard Gas & Elec., 8% pf.	56½	53½	57½
Standard Gas & Elec., 7% pf.	101½	....	....
Standard Gas & Elec., com.—no par.	54½	51	69
Standard Pwr. & Lt., 7% pf.	95	....	....
Staten Island Edison, pf.—$6—no par	95	....	....
Superheater, com.—no par.	151	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com	340	260	356
TAMPA ELEC., com.	46½	....	....
Tenn. Elec. Pwr., 6% pf.	90	....	....
Tenn. Elec. Pwr., 7% pf.	103	....	....
Terre Haute, Ind. & East Trac., pf.	22	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	l107	102	107½
Tide Water Pwr., 8% pf.	105	....	....
Timken Roller Bearing, com—no par	80½	44½	85
Toledo Edison, 8% pf.	l113	111	113
Toledo Edison, 7% pf.	l103	101	103
Toledo Edison, 6% pf.	l 104½	90	95
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88	87½	89
UNITED GAS & ELEC., 6% pf.	98	....	....
United Gas & Elec., com.—no par.	m 57	56	66
United Gas & Elec. (N.J.), 5% pf.	70	....	....
United Gas Impr.—50	c111½	....	....
United Lt. & Pwr. pf.—$4—no par.	49	....	....
United L. & P. pf.—$6.50—no par.	87½	85	88½
United Lt. & Pwr., com., A—no par	12	11	26
United Lt. & Pwr., com., B—no par	17	15	31
Utah Pwr. & Lt., 7% pf.	l 103½	99	103½
Utica Gas & Elec., 7% pf.	104½	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A	30½	28½	37
Utilities Pwr. & Lt., com. B—no par	13½	13½	18½
VERMONT HYDRO - ELEC., 7% pf.	95	94	96
Virginia Elec. & Pwr., 7% pf.	104	104	105½
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	b 70½	61½	85
Wagner Elec., com.—no par.	b 19	13½	34½
Washington Ry. & Elec., com.	f180	....	....
Washington Ry. & Elec., pf.	f 89½	....	....
Washington Wtr. Pwr., com.	132	130	136
West Mo. Pwr., 7% pf.	m 92	....	....
West Penn., 7% pf.	m113½	108	115
West Penn, com.	m125	118	130
West Penn Elec., pf.	k 99	95½	101
West Penn Elec., Class A.	k 95	88½	98½
West Penn Pwr., 6% pf.	k112½	108	115
West Va. Lt., Ht. & Pwr., 7% pf.	94½	95	98
West Va. Util ities. 7% pf.—50	47	43	48
Western Pwr., 7% pf.	98½	91½	99
Western States Gas & Elec., 7% pf.	92	....	....
Western States Gas & Elec., com.	17	....	....
Westinghouse El. & Mfg., com—50	68½	65	79½
Weston Elec. Instrument, Class. A.	k 32½	27½	32½
Weston Elec. Instrument, com.	k 16½	13½	19½
Wheeling Elec., pf.	95	91	97
Wis. Pwr., Lt. & Ht., 7% pf	95	85	90
Worthington Pump, pf. A	51	51	80
Worthington Pump, pf. B	k 42	40½	65
Worthington Pump, com	22½	19½	44½
YADKIN RIVER PWR., 7% pf.	l107	102	107½
Yale & Towne, com.—25	69½	60½	72½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Saturday, Nov. 6. *l*Bid, low, high, Wednesday, Nov. 10. *m*Latest quotations available

fall due serially—$500,000 on Dec. 15, 1927, and $500,000 on Dec. 15, 1928, the respective prices being 99.28 and 98.65 and the approximate yield for both maturities 5.95 per cent. Each one-thousand-dollar note will carry a detachable warrant, extending to the maturity of the note, entitling the warrant holder to purchase ten shares of the class A common stock of the corporation at $30 per share. These gold notes will be convertible up to the maturity date, unless called for redemption, and if so, then up to redemption date, into People's Light & Power Corporation 7 per cent cumulative preferred stock at the rate of ten shares of the par value of $100 each for each one-thousand-dollar note.

A small offering was made by the Texas Power Corporation in the form of general mortgage thirty-year 6½ per cent gold bonds to the amount of $400,000, the price being 99½ and interest, yielding about 6.55 per cent.

Bonds Called in November

Among the corporate bonds called for payment in November in advance of maturity were the following electrical securities:

Issues	Due	Amount
Westinghouse Elec. & Mfg., 7s	1931	$30,000,000
Counties Gas & Electric, 5s	1953	6,507,500
Kentucky Utilities, 1st E 6s	1949	4,500,000
Kentucky Utilities, 1st B 7s	1941	860,100
Ohio Service, A and B 6s	1937	2,158,500
Eastern Texas Electric, 5s	1942	1,857,000
Southern Cities Utilities, 6½s	1940	1,500,000
Southwestern Utilities, 8s	1936	992,000
Lake Charles Electric, 5½s	1949	750,000
Peninsular Power, 6s	1941	604,000
Mohawk Hydro-Electric, 6s	1940	377,000
North Carolina Public Service, B6s	1954	372,500
Piedmont Power & Light, 7s	1934	268,500
Piedmont Power & Light 6s	1934	102,300
Mississippi River Power, 7s*	1935	102,900
San Francisco Gas & Elec., 4½s*	1933	100,000
Connecticut Light & Power, 7s*	1951	84,000
Power Corp. of New York, 6s*	1942	10,000

* Not entire issues.

American Light & Traction to Recapitalize.—Stockholders of the American Light & Traction Company will vote Dec. 8 on a proposal (a) to create a new class of stock to be known as prior preference stock of the par value of $50,000,000, divided into 500,000 shares; (b) to decrease the authorized 6 per cent preferred stock from $25,000,000 to $14,236,200 (par $100). Stockholders of the old preferred stock will be offered the right to exchange their holdings for the new prior preference stock on a share-for-share basis.

Philadelphia Electric to Increase Capital.—The Philadelphia Electric Company has decided to increase its capital from $85,000,000 to $150,000,000 and issue stock allotment of 16⅔ per cent in common stock. Walter H. Johnson, president of the company, made this announcement Nov. 9. There will be a special meeting of the stockholders Jan. 15 to pass upon the proposed plans. The stock will be issued about March 15 and the funds raised will be utilized to finance next year's construction.

Manufacturing and Markets

American Machinery Supreme in British Islands

Sixty-five per cent of the industrial machinery imported into the British islands of Trinidad and Tobago in 1925 represented American-made products, according to the Industrial Machinery Division of the Department of Commerce. The value of United States machinery shipments to this market last year was $1,041,900, compared with British shipments of $539,000.

The outstanding feature of the market for 1925 was the increase in imports of mining machinery from the United States, rising from $760,321 in 1923 and $773,735 in 1924 to $980,949 in 1925 and representing an increase in the latter year of 27 per cent over 1924. The United States supplied in 1925 79 per cent of the mining machinery imports of Trinidad and Tobago, as against 19 per cent on the part of the United Kingdom, its nearest competitor.

This large volume of mining machinery imports was destined for the petroleum industry of the islands and includes all equipment used in this industry. The importance of the petroleum production of the colony is indicated by the exports of petroleum products, which in 1925 were valued at $7,536,035 and constituted one-third of all exports.

Turkish Trade Relations Require Treaty Ratification

In a communication to members of the United States Chamber of Commerce President O'Leary makes an appeal for prompt ratification of the Turkish treaty, which the Senate has agreed to consider in January, after the holiday recess. This action is necessary, he says, if American business in the Near East is to be placed upon as advantageous a footing as that of its European competitors. "The lack of treaty relations between the United States and Turkey," says Mr. O'Leary, "is a handicap to American trade with Turkey and the Near East. This trade today is not making headway. Business men are slow to invest capital and build up trading organizations in countries where their rights are not assured by definite and favorable treaties."

President O'Leary points out that 25 foreign governments, including all of the great powers, have entered into treaties with Turkey on terms no more favorable than those offered our own givernment. "Rejection now," he adds, "simply means continuance indefinitely of the present unsatisfactory status."

Young Praises International Chamber of Commerce

To present properly and effectively the viewpoint of American business men on world-trade problems, Owen D. Young, chairman of the American committee of the International Chamber of Commerce, recently urged affiliated organizations in this country to send a large and representative delegation to the general meeting of the chamber to be held at Stockholm, Sweden, next June.

In a letter inviting American business men to attend the Stockholm meeting, Mr. Young says: "The business men of the world must understand one another. They must learn to co-operate with one another. They must learn to have confidence in one another. Somewhere there must be a meeting place common to business men everywhere, whatever language they speak, under whatever laws they operate—a place where they can meet and discuss their common problems. I know of no other organization in the world adapted to this need except the International Chamber of Commerce."

The report of the American committee on trade barriers, of which Julius H. Barnes, former president of the United States Chamber of Commerce, is chairman, has already been submitted to the central committee. Among the points to which it directs attention are double taxation, lack of international protection of patents, trade marks and designs; lack of centralized credit information, lack of uniformity in commercial letters of credit, inadequacy of the international parcel post, antiquated customs classifications, and cumbersome and complicated customs formalities.

On the basis of its present membership in the International Chamber of Commerce, the United States would be entitled to send 400 delegates.

Quarterly Statistics of Power Switching Equipment

(Exclusive of oil circuit breakers, switchboards and fuses)

Data Obtained from National Electrical Manufacturers' Association—Apparatus Division

These figures were contributed by the following companies: Delta-Star Electric Company, Electrical Development & Machine Company, Electrical Engineers' Equipment Company, General Electric Company, Memco Engineering & Manufacturing Company, Pacific Electric Manufacturing Company, Railway & Industrial Engineering Company, Schweitzer & Conrad, Inc., and Westinghouse Electric & Manufacturing Company.

Products	Orders Entered, 1926			
	First Quarter		Second Quarter	
	Single-Pole Units	Value	Single-Pole Units	Value
Indoor disconnecting switches (single-pole units not included in switchboards)	10,776	$329,963.75	11,436	$359,639.52
Outdoor disconnecting and air-break pole-top switches (single-pole units not included in switchboards)	7,905	478,907.53	10,191	636,991.42
Bus supports	These figures are not given, because every company does not keep separate records of its bus-support business and it will not be possible to get these figures complete before the fourth quarter.			

Emergency Orders Slow Up, but Not Long-time Deliveries

Newspapers have reported that about 600 employees in the apparatus transformer department of the Pittsfield works of the General Electric Company were to be put on a schedule of three and one-half or four and one-half days a week beginning this week. The reason given was curtailment of orders.

Investigation of the facts by the ELECTRICAL WORLD indicate that the situation was greatly exaggerated and possibly misleading. Only about 350 men out of a total of approximately 75,000 were placed on this schedule owing to the fact that emergency orders for large transformers have slowed up. Orders for long-time deliveries have not declined.

Imports of Electric Incandescent Lamps and Bulbs Into the United States in August, 1926

	Bulbs		Carbon Filament		Metal Filament		All Others*	
	Number	Value	Number	Value	Number	Value	Number	Value
Austria	12,057	$725	106,500	$7,782	337,100	$23,951	.....	....
Belgium	443,897	3,777	26,425	103	.....	.....	.....	....
Czechoslovakia	40,540	421	28,000	2,392	14,900	1,176	.....	....
France	862	67	220	22	998	153	71	$37
Germany	12,000	1,064	1,489,116	60,582	167,031	15,067	203	141
Hungary	.....	.....	14,500	999	.....	.....	.....	....
Netherlands	847,736	8,562	.....	.....	.....	.....	.....	....
Rumania	.....	.....	4,000	350	.....	.....	.....	....
United Kingdom	.....	.....	.....	.....	.....	.....	37	464
Canada	.....	.....	.....	.....	.....	.....	56	108
Japan	12,000	469	1,585,480	51,717	341,106	11,149	500	615
Total	1,369,092	$14,585	3,254,241	$123,947	861,135	$51,496	867	$1,365

*Including neon, mercury and medical.

October Activity High

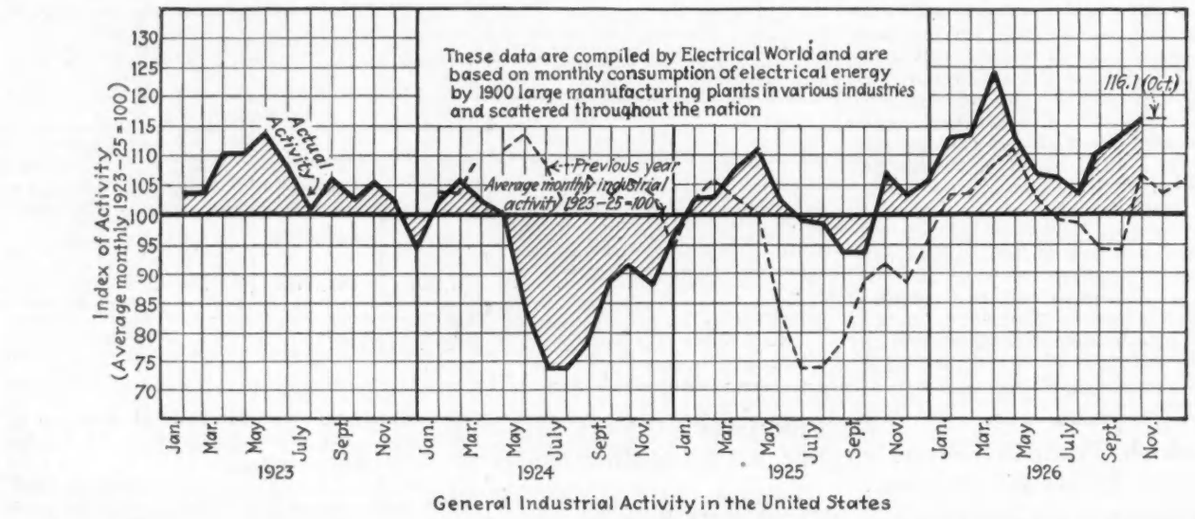
Metal and Textile Industries Increase Operations Slightly—Automobile Production Under Last Year

THAT the high activity of general industrial operations reported during August and September was continued, if not slightly increased, during October is indicated from reports of electrical energy consumption by manufacturing plants during these months. The metal and textile industries both reported slightly increased productivity over September, but October operations in the automotive, leather, lumber, and stone, clay and glass industries were slightly below those of September. October manufacturing activity in general was 7.4 per cent over that reported for October of last year and 15.3 per cent over the average monthly activity for the past three years. September operations were about 21 per cent over those of September last year. This decrease in the rate of activity between the same months of the two years, however, was not due to a decreased activity during the October just closed, but was due to a material increased activity reported in October last year. Such is the picture of industrial operations outlined in the data received by the ELECTRICAL WORLD and based on the monthly consumption of electrical energy by about 1,900 manufacturing plants in various industries and scattered throughout the nation—plants consuming more than 8,000,000,000 kw.-hr. per annum.

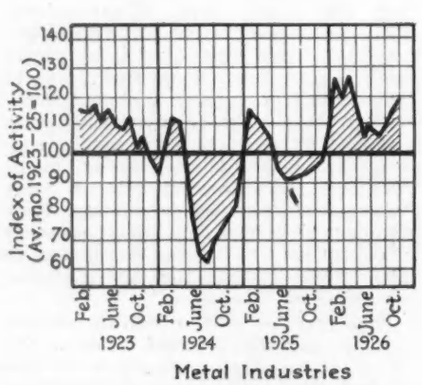
The metal industries of the nation reported October operations of 5.5 per cent over those of September, the same companies reporting energy consumption during October of 184,071,708 kw.-hr., as against 174,722,786 kw.-hr. in September, both months having the same number of working days. Approximately 68 per cent of these plants reported increased energy consumption during October over September. October activities in the metal industry, however, were about 5.4 per cent under those of last March, which was the peak month of general industrial activity so far this year. The rolling mills reported operations 5.3 per cent over those of September, and the fabricating branches of the metal industries reported October operations as 5.7 per cent over those for the month of September.

"Electrical World" Barometer of Industrial Activity in the United States as a Whole

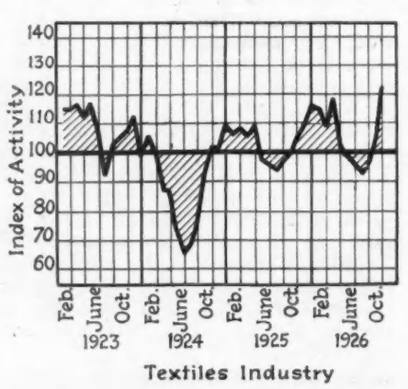
(Data Unadjusted for Seasonal Variation)


These data are compiled by Electrical World and are based on monthly consumption of electrical energy by 1900 large manufacturing plants in various industries and scattered throughout the nation
116.1 (Oct.)
Actual Activity
Previous year
Average monthly industrial activity 1923–25=100
Index of Activity (Average monthly 1923–25 = 100)
Jan. Mar. May July Sept. Nov.
1923 1924 1925 1926

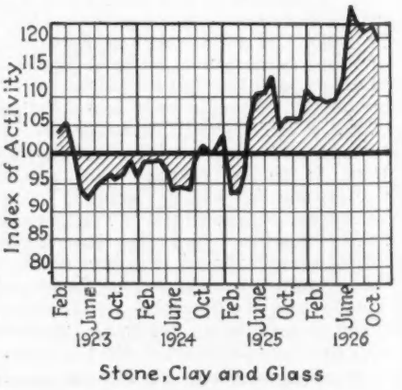
General Industrial Activity in the United States



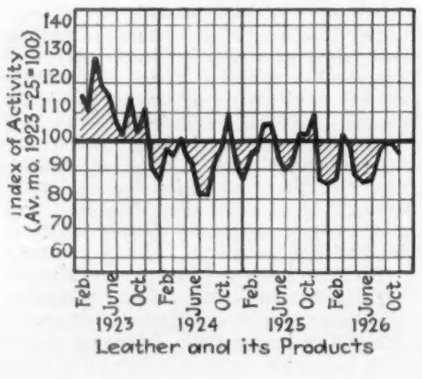
Metal Industries



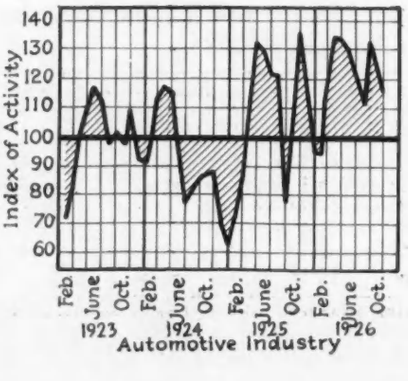
Textiles Industry



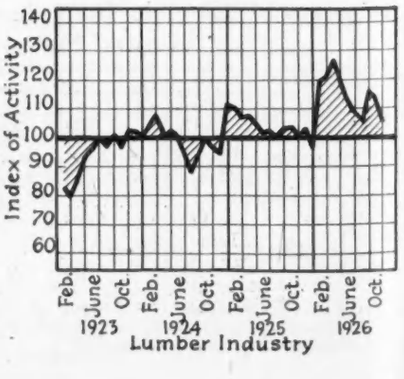
Stone, Clay and Glass



Leather and its Products



Automotive Industry



Lumber Industry

Business Conditions

EXCEPT for the southeastern part of the United States, transmission and heavy-equipment buying of electric service companies has slackened, as usually occurs in the late fall, most construction having been cleared up by that time. Utility demand for medium-size transformers, meters and pole-line materials continues steady in most sections. Approaching holidays and the resulting gift market are causing heavy purchases by jobbers of socket appliances. Industrial purchases of heavy equipment are rather spotted. For example, conditions in the Northwest lumber market are causing that industry to mark time, whereas there are diversified industrial purchases on other parts of the Pacific Coast. On the other hand, nearly every section reports a strong movement of medium-sized motors and control equipment. Fractional-horsepower motors are in demand among resale manufacturers of appliances and small tools. Small-equipment and supply buying of utilities, manufacturers and jobbers is bolstering up the usual seasonal lull at this time of the year.

Copper Market Shows Signs of Life

After three dull weeks copper sales have picked up materially. Concessions from the 13.875-cent level have been made by two sellers, but most sales have been made on the basis of 13.875 cents delivered in Connecticut. Most of the deliveries are for November, December and January, with a little sold as far ahead as February. Last Friday Copper Exporters, Inc., reduced its "foreign" from 14.40 cents to 14.25 cents. This presumably is in line with the policy of the association to keep the spread between foreign and domestic prices within reasonable limits. They do not want foreign fabricators to feel that they are being discriminated against. Sales for export, particularly to Germany, have been encouragingly large, both before and since the reduction in the official price of copper.

NEW YORK METAL MARKET PRICES

	Nov. 3, 1926 Cents per Pound	Nov. 10, 1926 Cents per Pound
Copper electrolytic	13.95	13.85–13⅞
Lead, Am. S. & R. price	8.00	8.00
Antimony	13¾	13
Nickel, ingot	35	35
Zinc spots	7.60	7.55–7.575
Tin, Straits	69¾	70¼
Aluminum, 99 per cent	27	27

Base copper price Nov. 10, 1926, 16½ cents.

Zinc had another extremely active week, with prices ranging from 7.15 cents up to 7.22½ cents. The price of zinc today is 7.22½ cents for immediate delivery, with futures quoted at 7.20 cents.

Lead has been selling in moderate volume at steady prices. Tin is inactive with higher prices for spot.

Socket Appliances Feature Southeast Buying

Unusually satisfactory buying of nearly all lines of socket appliances has occurred in the Southeast during the past week. There has been a noticeable tendency on the part of purchasers to stock the better class of appliances in anticipation of the excellent holiday trade. The heavier lines of appliances are also showing encouraging activity, with washing machines, vacuum cleaners and sewing machines showing more popularity than for some time past.

Pole-line materials in both the high-tension and distribution-line types continue to be active throughout the entire territory, while distribution transformers and meters maintain their steady volume of the past few months. Industrial motors, especially in the smaller sizes, are quite active, with a large volume of small orders. One manufacturer reports the receipt last week of two motor orders from textile manufacturers, one amounting to $18,000 and the other to $15,000. Another interesting order placed last week was for $60,000 worth of high-tension insulators for use in the northeastern part of the territory. High-tension substation switching equipment continues in strong demand, with a satisfactory number of inquiries in hand, and the largest single order last week for this equipment amounted to $17,000.

Announcement last week by one of the largest Southeastern companies of the proposed installation of a new large hydro-electric plant on the Savannah River has caused considerable interest and preliminary activity among the local representatives of large manufacturing interests.

Supplies Activity Bolsters New England Sales

With the approach of the usual seasonal lull in buying heavy electrical equipment this district is showing an encouraging activity in many lines of supplies and apparatus which bolsters up the trade and maintains a steadiness in the market. Small-motor sales dropped off in volume during the past week. On the other hand, the demand for fractional sizes is strong, and a number of large orders coming from appliance and tool manufacturers are reported which are recorded by one prominent manufacturer at more than $50,000 ordered in large lots to be delivered periodically. As compared with last year, the volume of fractional horsepower motors sold here this year will, another dealer declares, show a substantial gain. Inquiries for substation and central-station supplies for replacement and repeat orders continue to flourish, and wire, small switches and socket devices are in good demand. Many electric specialties are gaining in attention. Recording meters and electric control equipment for textile and pulp mills are active. One manufacturer reports sales in this district amounting to 20 per cent above the volume last year; another notes much interest among manufacturers of rayon goods and notes two complete installations in southern New England mills recently ordered.

Electric lighting fixture sales are increasing. Reports from a number of jobbers show that a revision to high-class decorative effects is remarked among buyers. Factory lighting projects are under way; recently two large installations in this district were made. Household appliance sales are strong and show for the past week over 10 per cent gain for a group of eastern Massachusetts central stations.

Industrial Buying Active in New York Region

Central-station buying in the New York district is inactive in practically all lines. Some inquiries are reported for quotations on transformers, but at present no orders of any consequence are being received. There is no demand for switching equipments, line hardware, circuit breakers, etc. In the industrial field the situation is better, a strong demand for motors and control equipments being reported. Sales of motors up to 10 hp. are brisk, and interest in large-size equipments is increasing, as evidenced by the volume of inquiries coming in. This interest is being displayed by diversified industries, and no single conspicuous order can be singled out for comment. Jobbers report steady buying of fair volume in all lines.

Business Good in the St. Louis Territory

Jobbers in the St. Louis district are doing a first-class autumnal business, even better than that reported in previous weeks. Good-sized shipments of electric ranges have been made to southwest Missouri, where favorable concessions have lately been made on rates for energy used in cooking, heating and other appliances. No large orders have been placed for transmission-line material in the past week, most of the outside work for this season having been cleared up. However, manufacturers all say that business in the small lines is coming along in good volume. There have been good shipments of medium-sized motors, transformers, meters and other central-station supplies and equipment.

Business More Active in Middle West

A trifle more activity was noticed this week in most sections of the Middle West. The volume of business was quite satisfactory and better business was anticipated. Industrial activity is holding up well with a remarkably large volume of building construction. Considerable interest in contracting circles is being aroused by the construction of a model home in one of the Chicago suburbs, exemplifying better building practices. Utility purchasing is steady and contributes considerably to the larger volume of business being transacted. Among the interesting orders placed this week was one for piping systems for a turbo-

generator unit valued at $500,000, spare turbine parts totaling $25,000, 671 auxiliary relays, 91 graphic ammeters and 150,000 lb. of solder. One large utility company also placed an order for electric vehicles valued at over $75,000. A considerable amount of underground construction work is being started, some of which will continue most of the winter. A good demand for pole-line hardware and distribution material was noted this week.

Jobbers' sales continue good. There has been a varied demand for most materials, with a particularly good demand for ventilating fans and blowers. Motor sales are somewhat slow. Appliances continue to move readily. Prices remain generally firm.

Marking Time in the Northwest

The lull in orders and inquiries for electrical apparatus, machinery, equipment, etc., prevailing during the past two or three weeks in the Northwest is becoming more pronounced, with indications of continuance until after the Christmas holidays. The lumber business is marking time, awaiting developments, and contemplated improvements to mills are not expected to be made until market conditions improve and better prices obtain. Seattle firms are expecting specifications soon for motors and apparatus for the proposed pulp and paper mill to be built in Longview, Wash., at a cost of $2,500,000, by the Longview Fiber Company. The Long-Bell Lumber Company, at Longview, will build a rip and trim plant to remanufacture lumber and will buy a battery of nineteen motors, aggregating about 600 hp. The Clearwater Timber Company, a Weyerhauser subsidiary, has purchased approximately $32,000 worth of conduit, switches, wire, condulets, reflectors, etc. A Seattle dairy company will soon buy several motors for ice machines.

Pacific Coast Purchases Are Diversified

October building permits for Los Angeles, San Francisco and Oakland total over $17,350,000, compared with $19,300,000 for the same month of 1925, but San Francisco permits are about 30 per cent more than last year. Power-company and railroad business has been very light this past week, an order for 100 7,500-volt line switches being an outstanding item. Government business includes an inquiry for 2,000 ft. of No. 1/0 triple-conductor varnished-cambric lead-sheath cable. Industrial orders include 9,000 ft. of conduit, principally 2-in. and 3-in., and 300 elbows for the same, for an elevator company; 3,000 stand-lamp clusters for a fixture manufacturer, and 1,000 switch assemblies, chiefly 60-amp., three-blade, for a manufacturer of pumping-plant panels. Dealer buying is gradually approaching a holiday basis, with such items as 50 vacuum cleaners and attachments, 100 washing machines, 200 trickle chargers, 40 air heaters (sizes 3 kw. to 6 kw.) and numerous hundred-dollar assortments of hollowware, percolator sets, waffle irons and curling irons predominating. Many of these orders specify early December delivery. A late holiday season is predicted.

It should be a good year for jobbers, because since 1924 was a year of heavy buying and light sales, the stocks carried over were practically all sold during 1925. This has been an excellent week for machinery and power apparatus, some interesting orders having been received for miscellaneous incidental equipment for five ferryboats, comprising 24 motors of various sorts for each boat, valued at $6,000; eighteen miscellaneous transformers, ranging from 7½ kva. to 25 kva. for general pumping service in the Hawaiian Islands, and six motors (sizes 200 hp. to 400 hp.) for a sugar plantation in the Hawaiian Islands—all valued at $20,000. An oil company has bought 50 oil-pumping outfits and fifteen motors for this purpose, also five of sizes 20-hp. and 50-hp., all valued at $25,000.

Activities of the Trade

Heating Device Manufacturers Meet in Mansfield

Many manufacturers of electric household appliances were represented in Mansfield, Ohio, when the heating devices section of the National Electrical Manufacturers' Association met at the Mansfield works of the Westinghouse Electric & Manufacturing Company last month. The principal object of this, the annual meeting of the section, was the election of officers. H. J. Mauger of the Edison Electric Appliance Company, Chicago, was elected chairman; A. T. Fish of the Lindemann & Hoverson Company, Milwaukee, secretary and J. S. Kennedy, of Landers, Frary & Clark, New Britain, Conn., treasurer. The thirteen members of the heating devices section in attendance at the meeting were entertained by the Westinghouse company and were conducted on a tour of inspection through the local Westinghouse factory, where household heating devices are manufactured.

Allis-Chalmers Business Continues to Gain

The Allis-Chalmers Manufacturing Company continues to gain in volume of business handled and net income. For nine months ended Sept. 30 a net profit of $2,580,220 was earned. Sales billed in the nine months aggregated $22,493,938 against $21,472,272 in the 1925 period, and unfilled orders on Sept. 30 totaled $13,323,324 against $10,143,743 on Sept. 30, 1925. There has been some slight recession in new business to date in the current quarter which should clear the plants for a more rapid outturn of orders now on the books, and this should increase billings and earnings.

Otto H. Falk, president of the Allis-Chalmers Manufacturing Company, expects no decline in business during the fourth quarter of 1926, and some acceleration in billings.

"For the first quarter of 1927 I see good business generally, which is as far ahead as I can safely estimate," General Falk said. "Public utilities have been going ahead with plans for expansion and our volume from this group next year should be large. There are several sizable public utility orders to be bid for before the end of the current year which, if we are successful in acquiring our share, would swell our 1926 volume above estimates. During October few large orders were received. Shipments increased and unfilled orders were therefore slightly less on Nov. 1 than they were a month previously. I should estimate that the Nov. 1 unfilled business would be less than $13,000,000."

Western Electric Sales Continue to Increase

The Western Electric Company, Inc., reports sales billed for the nine months ended Sept. 30 as $188,123,000, compared with $176,203,000 in 1925. During the first nine months of 1926 orders received aggregated $182,721,000, compared with $182,006,000 during the corresponding period of 1925. The orders on hand at Sept. 30, 1926, amounted to $85,417,000, compared with $92,339,000 at Sept. 30, 1925.

American Electrice Company Changes Name

The American Electrice Corporation has changed its name to the Belding-Hall Electrice Corporation. Charles B. Bohn, president of the Bohn Aluminum & Brass Company, Detroit, has been appointed chairman of the company, and Arthur L. Cash, formerly head of the Northway Motors Division of General Motors, vice-president and general manager. The offices of the building, now at 475 Fifth Avenue, will be moved to Belding, Mich. In addition to the above action the directors declared the regular quarterly dividend of 43¾ cents on the preferred stock.

Westinghouse Receives Large Circuit-Breaker Orders

The Westinghouse Electric & Manufacturing Company has recently received several large orders for circuit breakers from the Detroit Edison Company, the Appalachian Electric Power Company, the Dixie Construction Company, the Ohio Public Service Company and the Metropolitan Edison Company.

The Detroit Edison Company order calls for fourteen 400-amp., and five 1,200-amp., 37-kv. electrically operated O-441 breakers. The Appalachian Electric Power Company of Red Star, W. Va., and the Metropolitan Edison Company of Reading, Pa., have both ordered type G-22 breakers. The former's order called for ten 400-amp., 50-kv. electrically operated outdoor breakers, and the latter's for two 400-

amp., 132-kv. electrically operated breakers. The Ohio Pubiic Service Company's order specifies four 400-amp., 73-kv. outdoor electrically operated type G-222 breakers for its station at Mansfield, Ohio, and the Dixie Construction Company, for the Georgia Railway & Light Company's transformer station at Dublin, Ga., has ordered one 400-amp., 73-kv. manually operated outdoor G-11 breaker, three 400-amp., 50-kv. alternating-current motor-operated outdoor G-11 breakers. This order also included four 1,500-kva., 6,600-volt transformers and one twelve-panel switchboard.

Net Profit of $2,764,921 Reported by Electric Refrigeration

The tentative report of the Electric Refrigeration Corporation and subsidiaries for the nine months ended Sept. 30, 1926, shows a net profit of $2,764,-921 after all charges and federal taxes, Net profit after above charges for third quarter of 1926 totaled $252,488, compared with $1,673,483 in preceding quarter and $969,885 in quarter ended March 31, 1926. Current assets on Sept. 30 total $8,157,561 and current liabilities $822,108.

The Kerite Insulated Wire & Cable Company, Seymour, Conn., has awarded a contract to the H. Wales Lines Company, Meriden, for a new two-story addition, heavy mill type, to be used for loading service.

The H. P. Electric Company, Bloomington, Ind., manufacturer of electrical apparatus, has plans under way for a new local plant to cost close to $40,000, with equipment.

The Howell Electric Motors Company, Howell, Mich., has awarded a general contract for a one-story factory addition, 40 ft. x 200 ft., estimated to cost about $45,000, with equipment, and will begin work immediately.

The Delco-Light Company, Dayton, Ohio, manufacturer of electric lighting and starting systems, has taken out a permit to construct a one-story addition between present buildings Nos. 8 and 9, on Amelia Street, to cost about $21,000.

The Ideal Electric & Manufacturing Company announces that F. G. Ruhl, formerly with the Wagner Electric Corporation, is now associated with the Ideal company in its New York office, 50 Church Street.

The F. W. Wakefield Brass Company, Vermilion, Ohio, announces an improved "Red Spot" kitchen lighting unit.

The Link-Belt Company, Chicago, has extended the horsepower range of silent-chain drives available from distributors' stocks from its present scale of ½ hp. to 10 hp. in practically any reduction from one to one up to seven to one. The step-up to 15 hp. is the first change made by the Link-Belt Company in the original plan of stock drives distribution, but does not in any way interfere with engineering drives which this company has furnished for more than 20 years up to and above 1,000 hp. James S. Watson, manager of the Dodge works and the company's silent chain division, recently stated that it is now possible to obtain Link-Belt silent-chain drives from distributors' stocks in virtually any city in the United States within 24 hours.

The Moloney Electric Company, South Seventh Street, St. Louis, Mo., is pushing construction on its new plant at Union Street and the Kingshighway, comprising a main two and three-story U-shaped building, with wings 100 ft. x 600 ft. and 100 ft. x 750 ft. The plant will be used for the manufacture of transformers of heavy type and is estimated to cost close to $1,000,000, with machinery. The company also has preliminary plans for a one-story auxiliary plant structure, 100 ft. x 300 ft., and will begin work on this building at a later date.

The Electric Household Utilities Corporation, Chicago, through its general sale manager, E. S. Ridgway, announces the following appointments in company personnel: Frank J. Simpson, assistant to sales manager in charge of jobbing territories exclusive of those under branch office jurisdiction; Frank L. Johnson, assistant to sales manager in charge of open territories exclusive of those under branch office jurisdiction; C. A. Gustafson, assistant to sales manager in charge of contact with branch offices, Thor shops and foreign sales; Jane Erickson, assistant to sales manager in charge of sales promotion; J. F. McManemin, advertising manager, and D. S. Passmore, manager statistical department.

The American Bosch Magneto Corporation, Springfield, Mass., is now giving its attention to the manufacture of radio equipment. Orders for a receiving set recently placed on the market already exceed $3,000,000. Capacity schedules are in force at the company's Brightwood plant, employing 2,000 hands. The company anticipates an increasing business through the winter. Estimated profits for the year are expected to reach $2.50 per share.

The Sta-Warm Electric Heater Corporation, formerly of Minneapolis, manufacturer of electrical appliances, has purchased and now occupies at Ravenna, Ohio, a new and fully modern manufacturing plant which affords several times the former production capacity.

New Equipment Available

Suspension Insulator

A new Franklin suspension insulator of improved design and manufactured by the Franklin Porcelain Company, Norristown, Pa., has been placed on the market by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia. The cement surfaces of the new insulator are covered all over with a coat of expansion compound, giving a resilient joint and protecting it against thermal strains. The company says that, through corrective load application, this insulator withstands tests showing a combined mechanical and electrical strength of 22,000 lb. to 23,000 lb.

Motor-Driven Reels for Large Electric Cranes

A special motor-driven cable reel for use on large electric cranes is being marketed by J. L. Gleason & Company, 241 Franklin Street, Boston. A duplex outfit has also been designed for heavy service. The reel and motor-drive units are fastened to and travel with a large direct-current crane. As the crane moves forward the two reels unwind, and when it reverses the cable is automatically rewound on each drum. The motors are arranged to wind faster than the speed of the crane and hence exert constant pressure, but are designed not to burn out even if stopped with full current on. Cranes of this type are usually fed through rail or trolley connections, but in certain cases it is necessary to allow no live conductors ahead of the working parts of the crane, especially where the bucket swings over the crane rail or roadway. In the above crane equipment the insulated cables are wound on reels carried on the rear of the crane and are thus well out of the way. The collector rings are covered when installed.

Clip-Type Safety Connector.—A new clip-type safety connector designed and manufactured by the Westinghouse Electric & Manufacturing Company for use on test floors in college laboratories and other places where a well-insulated safety connector is desired eliminates the possibility of accidentally or carelessly kicking out the connector plugs. This safety feature is accomplished by means of a lever-operated, movable plunger which is forced into a groove in the plug, holding it securely. The connector plug cannot be removed until the plunger is released by pulling up the lever. This safety connector is also designed for switchboard mounting.

Insulating Material.—A new type of insulating material which is being used by the General Electric Company for the production of radio high-frequency insulators is said to solve the problem of an improved insulator for such high frequencies as are encountered in radio work, as well as to provide more efficient utilization of materials. The new insulation, known as "Mycalex," is a composition of ground mica and lead borate. The new material has better insulating properties than has porcelain, and several applications for it have been developed by the company. Chief among its characteristics are that metal parts may be inserted or combined with it during the process of molding and, that, although a hard and stone-like product, it can be subjected to ordinary machining methods. It is said to have better electrical properties than porcelain and is stronger mechanically, except under compression.

New Trade Literature

ROLLER BEARINGS. — The Timken Roller Bearings Company, Canton, Ohio, has issued a new edition of the "Timken Engineering Journal" (loose-leaf) which contains technical information relative to the application of Timken bearings to automotive and industrial machinery. Typical problems, with the solutions, involving the calculations of various loads and the selection of suitable bearings, are given. Tables showing ratings, capacities and dimensions of bearings, as well as speed capacity curves, are included.

LEAD-BASE BABBITTING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing folder 4,474, describing the babbitting of bearings and explaining the use of the Westinghouse automatic electric babbitting pots. A description of the lead-base babbitt, alloy No. 25, a product of the Westinghouse company, is also included.

TREE WIRE.—The Okonite Company, Passaic, N. J., has issued a booklet entitled "Tree Wire" in which it describes uses and advantages of the Okonite tree wire when electric light and power lines must be strung through trees. Instructions are given for stringing the wires. Illustrations showing various applications are included.

ELECTRIC METER.—Bulletin No. 253 issued by the Bacharach Industrial Instrument Company, 7,000 Bennett Street, Pittsburgh, covers the Bacharach electric CO meter for carburetor adjustment of high-speed internal-combustion engines. This bulletin discusses the composition of internal-combustion exhaust gases, and included are tests made with engines on test stand. Attention is also called to the "Maihak" type indicator No. 4 for automobile, aëroplane and other high-speed engines.

INDUSTRIAL HEATING.—The Buffalo Forge Company, Buffalo, is distributing catalog No. 466, describing the Buffalo unit heaters for industrial plants, including factory buildings, steel mills, large stores, warehouses, machine shops, etc. A number of illustrations are given showing typical installations of the heating unit. Attention is also called to the Buffalo direct-fired units to serve plants, warehouses, etc., where steam is not available.

BALL BEARINGS.—The Fafnir Bearing Company, New Britain, Conn., has issued a booklet in which it calls attention to the economies effected by the use of ball bearings in electric motors. It contains facts, figures, experiences and illustrations of the Fafnir ball bearings in various plants. This booklet is of special interest to superintendents, maintenance and electrical engineers.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Ghent, Belgium (No. 22,838), for electric-driven vehicles.

An agency is desired in Paris, France (No. 22,843), for milking machines; also for industrial electric furnaces (No. 22,855).

Purchase is desired in Montevideo, Uruguay (No. 22,836), of electric automobile accessories.

Purchase is desired in Charlottetown, P. E. I., Canada (No. 22,854), of dry-cell batteries, best quality.

An agency is desired in Colombia, South America (No. 22,821), for flashlights.

Purchase and agency are desired in Arnstadt, Germany (No. 22,846), for electric heating devices and water heaters.

Purchase and agency are desired in Melbourne, Australia (No. 22,845), for electrical household appliances, radio sets and parts. Purchase is also desired of electric-driven car-wheel lathes (No. 22,878).

An agency is desired in St. John, New Brunswick, Canada (No. 22,814), for motor-driven household devices, electric heating and cooking devices, vacuum cleaners and refrigerators.

Purchase and agency are desired in Durban, South Africa (No. 22,856), for lighting outfits (self-contained), machinery and appliances, electric generators, switch gear and motors.

ELECTRICAL EQUIPMENT FOR THE WAIKAREMOANA (NEW ZEALAND) POWER PROJECT.—Tenders will be received by the New Zealand Public Works Department, Wellington, New Zealand, for furnishing electrical equipment for the Waikaremoana electric power project as follows: Until Jan. 4, 1927, for furnishing switchgear and transformers; until Jan. 18, 1927, for steel towers for transmission lines (section 31), and until Feb. 1, 1927, for storage batteries and boosters (section 28).

ELECTRIC EQUIPMENT FOR EGYPTIAN PUMPING AND POWER STATION. —Tenders will be received by the Egyptian Ministry of Public Works, Cairo, Egypt, until Jan. 1, 1927, for furnishing and installing at the Seru pumping and power station four Diesel engine-driven alternator sets, three pumps and accessories.

ELECTRIC RIVET HEATERS FOR MELBOURNE, AUSTRALIA. — Specifications have been issued by the Victorian Railways Commission, Melbourne, Australia, for electric rivet heaters for which tenders will be received until Dec. 29. Copies of the specifications will be lent by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, to American firms interested. Refer to No. Australia 44,135.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Plans are under way by the Edison Electric Illuminating Company of Boston to build a substation on Hawley Street, to cost about $750,000.

NORTHAMPTON, MASS. — The Northampton Electric Lighting Company plans to extend its lines to the West Farms section.

WHITMAN, MASS.—A site has been acquired by the Edison Electric Illuminating Company of Boston adjoining Hobart Pond, on which it proposes to erect a transformer station.

Middle Atlantic States

ANDOVER, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, has applied for approval of franchises granted by the village and town of Andover and for permission to exercise the rights given by the franchises.

DOWNSVILLE, N. Y.—The York State Gas & Electric Corporation, Ithaca, which acquired the electric plant of the Holmes Milling Company, plans to install a substation at Hamden and erect a transmission line to Downsville.

ELMIRA, N. Y. — Application has been made by the Elmira Water, Light & Railroad Company for permission to issue $2,000,000 in securities, the proceeds to be used for extensions and improvements. The proposed work will include the installation of a 6,000-kw. turbine, a new boiler with pulverized fuel equipment, condenser, water and steam piping, pumps, economizer, etc., and equipping third existing boiler to burn pulverized fuel; it is also proposed to erect on steel towers, a 110,000-volt, double circuit transmission line from Elmira, about 68 miles north, to connect with the lines from Niagara Falls, and also substation at Elmira of 10,000 kw. capacity, to reduce the voltage for distribution.

GAINESVILLE, N. Y. — The Niagara Falls (N. Y.) Power Company plans to erect a transmission line from Gainesville to Hardys and vicinity, including the Delhi district.

HERKIMER, N. Y.—The Town Commission has instructed the municipal attorney to draw up a contract for the standby electric service from the Utica (N. Y.) Gas & Electric Company. The Municipal Commission plans to build its own transmission line.

NEW YORK, N. Y.—Plans have been filed by the Department of Water Supply, Municipal Building, for the construction of a switching station on Sedgwick Avenue.

NEW YORK, N. Y.—Bids will be received by the State Hospital Commission, Fourteenth Floor, Flatiron Building, New York City, until Dec. 15 for construction, heating, sanitary, electric work and elevators, for the New York State Psychiatric Institute, New York City. Sullivan W. Jones, Capitol, Albany, is state architect.

OSWEGO, N. Y.—The City Council has voted in favor of entering into a contract with the Carlisle interests for the development of the city's water power, estimated at 7,500 hp., at the west end of Dam 6 in the Oswego River, the term of the lease not to exceed 25 years. The Carlisle interests have offered an annual rental of $50,000 and have agreed to build a plant, to cost about $850,000, this plant to revert to the city at the expiration of the lease. This proposal will be submitted to the taxpayers at a special election.

WOLCOTT, N. Y.—The Northern Wayne Electric Light & Power Company has applied for permission to extend its transmission lines in the towns of Savannah and Butler to furnish electrical service. This extension will permit the company to secure an additional supply of electricity when needed, from the Niagara, Lockport & Ontario Power Company.

BELLEVILLE, N. J.—The Public Service Electric & Gas Company, Newark, plans to erect a transmission line through Belleville, Nutley and Bloomfield.

CLIFTON, N. J. — The installation of ornamental lighting systems in various business sections of the city are under consideration by the City Council.

JERSEY CITY, N. J.—Plans are being prepared by J. T. Rowland, Jr., for a nurses home and remodeling power house, including the installation of two 75-hp. boilers, at Christ Hospital, 176 Palisade Avenue, to cost about $15,000.

MILBURN, N. J.—The Township Committee is considering a petition for the installation of an ornamental lighting system on Milburn Avenue from Spring Street to Holmes Place, to be maintained by underground wires.

TRENTON, N. J.—Permission has been granted the Public Service Electric & Gas Company to install a 132,000-volt power cable across the Delaware River, about 2 miles from Trenton. The work will be carried out in conjunction with the Buck Falls Electric Company.

HAGERSTOWN, MD.—Plans are being prepared for a new municipal electric plant for which $300,000 in bonds have been authorized. Louis T. Klauder, Bankers' Trust Building, Philadelphia, is engineer.

ROMNEY, W. VA.—The South Branch Power Company, Philadelphia, has applied for a preliminary permit to build three dams on the Cacapon River and four dams on the south branch of the Potomac River in Morgan, Hampshire, Grant and Hardy Counties. The power is to be used for utility purposes.

WELLSBURG, W. VA.—Plans for a proposed local steel fabricating plant to cost about $300,000, include a power house. The Ohio Valley Industrial Corporation, Central Union Trust Building, Wheeling, is interested in the project.

WEST UNION, W. VA.—Plans are being prepared by the Mountain State Utilities Corporation of West Virginia, which has acquired the local property of the Midland Electric Service Company and the plant of the Salem Electric Company in Salem, for the erection of a transmission line to connect the two systems and for other improvements.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 18, for 35,000 ft. lighting and power wire (Schedule 6249).

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 17 for a 150-kw. engine-driven, direct-current generator for the Naval Hospital, Washington.

North Central States

GRAND RAPIDS, MICH. — A power plant will be installed in connection with proposed additions to the local plant of the Leonard Refrigerator Company, on which work has been commenced. The equipment will include two 1,250-kw. turbo-generators, boilers, etc.

AKRON, OHIO.—The Goodyear Tire & Rubber Company plans to install electric power equipment in its proposed mill addition, to cost about $300,000, and also in a new extension, to cost about $150,000.

ASHTABULA, OHIO.—The City Council is considering a proposal submitted by the

Cleveland Illuminating Company, for the purchase of the municipal electric light and power plant. The company proposes to furnish local service from its transmission line to Conneaut, Geneva and vicinity.

CINCINNATI, OHIO.—The Union Gas & Electric Company is considering the construction of an equipment storage, and distributing plant, to cost about $50,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 19 for power transformers for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 19 for one teletype system for the Division of Police, Department of Safety. Bids will also be received at the same time and place for equipment for the police signal and recall system for the fifteenth precinct station, Division of Police, Department of Safety.

LOUISVILLE, KY.—Extensions to the ornamental lighting system in the business district is under consideration by the Board of Public Works.

LOUISVILLE, KY. — Bids will be received at the United States engineer office, Louisville, until Nov. 30 for building power houses at Dams Nos. 47 and 51 on the Ohio River.

BEECH GROVE, IND.—The Cleveland Grain & Milling Company, Engineers Building, Cleveland, plans to install electric power equipment in its proposed local grain bleaching and milling plant, to cost about $450,000.

CHICAGO, ILL.—The Pressed Steel Coal Company has engaged Thomas E. Murray, Inc., engineers, 55 Duane Street, New York City, to make a complete survey of the power requirements at its Chicago plant.

LOMBARD, ILL.—The municipal electric distribution system has been acquired by the Public Service Company of Northern Illinois, 72 West Adams Street, Chicago. Work will start at once on the construction of a substation on Highland Avenue, Westmore, recently annexed to Lombard.

TAYLORVILLE, ILL.—The Chicago & Illinois Midland Railway Company plans to install electric power equipment in the proposed addition to its local car shops, to cost about $100,000.

VANDALIA, ILL. — Arrangements are being made by the Illinois Power & Light Corporation, Chicago, to connect Vandalia with its transmission line serving Mulberry Grove from the west. The company plans to erect a substation in Vandalia, which will serve Cahokia, Belleville, Venice, Hillsboro and the Keokuk dam vicinity. The municipal electric plant is to be dismantled.

BLANCHARDVILLE, WIS. — The Wisconsin Power & Light Company, Madison, has awarded a general contract for construction of an addition to its local plant, to cost about $40,000.

CHILTON, WIS.—The Wisconsin Public Service Corporation, Green Bay, plans to build a new substation in Chilton.

MERRILLAN, WIS.—The Village Board has voted to appropriate $9,400 for an oil-engine-driven generating unit to supplement the output of the municipal water power plant. A power station will be built to house this equipment.

NEENAH, WIS. — The installation of ornamental lamps on Wisconsin Avenue and Commercial Street is under consideration by the City Council.

STOUGHTON, WIS. — The City Council has voted to build a new municipal electric plant at Dunkirk. The Power Engineering Company, 621 Metropolitan Life Building, Minneapolis, is engineer.

STOUGHTON, WIS. — Plans are under way by the city officials for the erection of an electric transmission line on Highway 106 to Hoveland, a distance of 4 miles, to supply electricity from the municipal electric plant in Hoveland and also to serve fifty farms in north Rutland.

WALES, WIS.—Plans are being prepared by A. Peabody, State Capitol, Madison, for a power plant at the State Sanatorium, to cost about $50,000. A. W. Bagly, Madison, is secretary of Board of State Control.

DULUTH, MINN. — Steps have been taken by the Chamber of Commerce to secure improvements to the street-lighting system.

EVAN, MINN.—An election will soon be held to vote on the proposal to issue bonds to establish an electric light and power service in Evan.

BAGNALL, MO. — Arrangements are being made by the Missouri Hydro-Electric Power Company, care of R. W. Street, Land Bank Building, Kansas City, for the construction of its proposed hydro-electric power plant at Bagnall, to cost about $1,500,000, with transmission system. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, is engineer.

KANSAS CITY, MO.—The City Ice Company, Twenty-first and Campbell Streets, plans to convert several of its ice-manufacturing plants in the city from steam to electric-drive, at a cost of about $100,000. The Henrici-Lowry Engineering Company, Security Building, is engineer.

FARGO, N. D.—Surveys are being made for extensions and improvements in the street lighting system. It is proposed to replace the present 32-cp. lamps with 400-cp. units in the business district.

BRYANT, S. D.—The City Council has adopted a resolution authorizing the purchase of a 60-hp. Fairbanks-Morse Diesel engine and generator for the municipal electric plant.

CREIGHTON, NEB. — The Interstate Power Company, Decorah, Iowa, plans to erect a 66,000-volt transmission line from Wynot to Creighton, with branch lines to O'Neill, Neligh and vicinity, covering about 90 miles.

HARTINGTON, NEB. — Permission has been granted the Hartington Electric Light Company to issue $375,000 in bonds and $50,800 in capital stock, the proceeds to be used for the construction of an electric plant. A separate company is being organized to erect a transmission line to Crofton and to serve residents along the line.

WALLACE, NEB.—Permission has been granted the Northwestern Public Service Company, Huron, S. D., to erect a transmission line, connecting its line from North Platte to Sutherland and from Sunderland to Wallace, to supply electricity for the local municipal electric system for which bonds have been voted.

ARGENTINE, KAN.—The Vulcanic Ash Company of America, Kansas City Life Building, Kansas City, Mo., plans to install electric power equipment in its proposed local pumisite plant, to cost about $100,000.

Southern States

CHARLOTTE, N. C.—The Piedmont Northern Railroad Company, Charlotte, is planning to build several substations in connection with the proposed extension of its electric railway to Gastonia, and also from Charlotte to Durham.

ELKIN, N. C. — The Elkin Furniture Company plans to install electric power equipment in connection with the proposed rebuilding of its plant, recently damaged by fire, with loss of about $125,000.

LENOIR, N. C.—A preliminary permit for three years has been granted to A. A. Shuford and F. M. Laxton, 900 Realty Building, Charlotte, for a power project on Wilson Creek within Pisgah National Forest. The plans include a dam across Wilson Creek, power station 1 mile below, with conduit leading from dam to power house.

GREENVILLE, S. C.—The Chicopee Manufacturing Company, Chicopee, Mass., plans to build a steam-operated electric power plant at its proposed local cotton mill. The cost of the entire project is estimated at $2,000,000.

AUGUSTA, GA.—Application has been filed by the Savannah River Power Company with the Federal Power Commission for permit for a large hydro-electric development on the Savannah River, near Clark's Hill, S. C., about 21 miles from Augusta. The project includes the erection of new transmission lines to Atlanta, Charleston and Macon. The plans provide for a development of 120,000 horsepower, to cost about $20,000,000.

BAXLEY, GA.—The municipal electric distribution system has been purchased by the Georgia Southern Power Company, Dublin. The service will be supplied by the present steam plant, pending the erection of a transmission line to Baxley.

LEARY, GA.—The town of Leary is reported to have contracted with the Baker County Power Company, Newton for hydro-electric power. The company, it is understood, is negotiating with the towns of Arlington, Morgan, Edison and Damascus to furnish power.

TAMPA, FLA.—The Tampa Shipbuilding & Engineering Company plans to install electric power equipment at its proposed shipbuilding and repair plant, to cost about $300,000.

CHATTANOOGA, TENN.—The installation of an improved lighting system on several streets in the down town district is under consideration.

NASHVILLE, TENN.—The City Council is considering the installation of an ornamental lighting system on Elliston Place.

ENSLEY, ALA.—Contract for the installation of an ornamental lighting system in the business district, to cost about $15,000, will soon be awarded. The Birmingham Electric Company will have charge of the installation.

McCOMB, MISS.—The Mississippi Central Power Company, which recently acquired the property of the McComb & Magnolia Light & Railway Company, is planning to extend its transmission lines to serve the principal industries in this section.

NETTLETON, MISS. — The Nettleton Light & Power Company has awarded contract to the Wooley Electric Company, Tupelo, for installing an electric light plant.

RUSSELLVILLE, ARK. — Plans are under consideration by the Arkansas Light & Power Company, Pine Bluff, to erect a 66,000-volt transmission line to connect the Russellville and Morrilton with its main system.

JACKSON, LA.—A franchise has been granted to Davis Stewart, Natchez, Miss., to construct and operate a local electric light and power plant, to cost about $100,000. A company will be organized to carry out the project.

ANADARKO, OKLA.—An election will be held Nov. 23 to vote on the proposal to issue $40,000 in bonds to purchase a 500-hp. Diesel oil engine and generator for the municipal electric plant. H. E. Musson & Company, Grain Exchange Building, Oklahoma City, are engineers.

BESSIE, OKLA.—Plans have been prepared by the Southwestern Light & Power Company, Braniff Building, Oklahoma City, for the erection of a 22,000-volt transmission line from Bessie to Weatherford, a distance of 24 miles, to cost about $45,000. E. R. Ernsberger, Braniff Building, Oklahoma City, is engineer.

TULSA, OKLA.—The erection of a 30,000-volt transmission line from Tulsa to Choteau, about 40 miles long, is contemplated by the Public Service Company of Oklahoma.

WILSON, OKLA.—Plans are being considered by the Oklahoma Gas & Electric Company, Oklahoma City, for the erection of a 22,000-volt transmission line from Wilson to Healdton, 20 miles long, to cost about $40,000. The Byllesby Engineering Company, 231 South La Salle Street, Chicago, is engineer.

HOUSTON, TEX.—Plans are being considered by the City Council for extension to the ornamental lighting system several blocks in the business district.

HOUSTON, TEX.—Work will begin at once by the Houston Lighting & Power Company on the erection of 66,000-volt transmission line, 20 miles long, from its plant on the ship channel to the Humble oil field to supply electricity in that district.

KINGSLAND, TEX.—Work will soon start on the first of the projected series of six dams to be built in the Colorado (Texas) River for the purpose of storing water for the large hydro-electric plants of the Syndicate Power Company, Dallas. This dam will be located at Kingsland and will be 2,500 ft. long and 165 ft. high.

MARTINSVILLE, TEX. — Plans are under way by the Texas Public Utilities Company, Dallas, for construction of a 60-ton ice plant, to cost about $75,000.

Pacific and Mountain States

CHEHALIS, WASH.—The Puget Sound Power & Light Company, Seattle, has applied for a franchise covering a rural extension of lines in Lewis County to include six roads.

PENDLETON, WASH.—The proposal to amend the city charter permitting the formation of lighting improvement district will be submitted to the voters. The desire to secure an improved street-lighting system in the business district is behind the movement.

PORT ANGELES, WASH.—The Puget Sound Power & Light Company, Seattle, has been granted a franchise to furnish electricity to industries on the Olympic

Peninsula. The company plans to extend a new cable across Hood Canal and erect new lines, etc., to cost about $60,000.

RAYMOND, WASH.—A franchise has been granted the Willapa Electric Company by the Commissioners of Lewis County to extend its transmission throughout the county, furnishing service to many districts now without electrical service.

ROCHESTER, WASH.—A franchise has been granted the Peoples Utility Company to extend its transmission line on Lincoln Creek, a distance of 5 miles.

SEATTLE, WASH.—The electrification of 10 miles of track between Black River Junction and Seattle, to cost about $250,000, is under consideration by the receivers of the Chicago, Milwaukee & St. Paul Railroad.

TUMWATER, WASH.—The installation of electric power equipment in the proposed new mill of the Tumwater Paper Mills to cost about $500,000 is contemplated. L. A. DeGuere, 262 Grand Avenue, Wisconsin Rapids, Wis., is engineer.

BEND, ORE.—The Des Chutes Power Company, Prineville, Ore., has applied for permission to erect transmission lines in different parts of Des Chutes County, covering about 17 miles.

EL SEGUNDO, CAL.—Plans are being prepared by the Southern California Edison Company, Los Angeles, for a local substation to cost about $140,000.

HANFORD, CAL.—Bids will be received by E. F. Pickerill, clerk of Kings County, for power house, heating plant and laundry building. A. Johnson, Call Building, San Francisco, is architect.

MADERA, CAL.—The City Council is considering the installation of a municipal fire-alarm system.

MODESTO, CAL.—The installation of an ornamental lighting system in the western section of the city, to cost about $60,000, is under consideration.

MONTEREY PARK, CAL.—The City Council contemplates the installation of ornamental lamps on a number of streets.

PASADENA, CAL.—The City Council has approved the installation of ornamental lamps on La Loma Road, between Avenue 64 and the west city limits, and other streets.

PETALUMA, CAL.—Improvements are contemplated by the Pacific Gas & Electric Company, San Francisco, to its local system, to cost about $2,500.

SAN FRANCISCO, CAL.—The Great Western Power Company, will soon begin surveys for the erection of a steel tower transmission line from its power plant in the Feather River Canyon, to the Bay district, duplicating the existing line.

TRACY, CAL. — The Banta-Carbona Irrigation District is considering calling an election to vote on the proposal to issue $334,000 in bonds for enlarging pumping plants, installing pumps, extending sublaterals, etc.

STRATTON, COL.—Extensions are contemplated to the municipal electric plant, including an addition to the building and installation of new equipment.

PUEBLO, COL. — The Loose-Wiles Biscuit Company, Kansas City, Mo., plans to install electric power equipment in its proposed local factory, to cost about $750,000.

Canada

MACCAN, N. S.—The construction of a large power development near Maccan, to cost between $400,000 and $500,000, is under consideration by the Canada Electric Company, Ltd., Amherst.

OTTAWA, ONT.—The Canadian International Paper Company, Ottawa, has applied to the Quebec Public Service Commission for authority to build a large power plant on Mountain Falls on the shores of the Red River in Harrington East Township. The plans provide for a development of 40,000 hp.

BRYSON, QUE.—Plans are under consideration by the Ottawa River Power Company, Dominion Express Building, Montreal, for the installation of two additional generating units of 25,000 hp. each at its local plant.

CARILLON, QUE.—Arrangements have been completed between the provinces of Quebec and Ontario for the leasing of the Carillon waterfalls on the Ottawa River to the National Hydro-Electric Company, Ltd., which is operating a hydro-electric plant at Carillon. The company is granted a lease for a period of sixty years under the terms of which it must start work on the project before Dec. 1, 1927, and must develop 100,000 hp. before 1932.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 12, 1926)

1,603,102. ALTERNATING-CURRENT-MOTOR CONTROL; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 29, 1926. Means for operating electric motors either as direct and alternating current motors or as alternating current regenerative braking generators; particularly applicable to electric railway locomotives having a plurality of driving motors of the series commutator type.

1,603,137. CONTROLLING APPARATUS AND SYSTEM; F. W. Myer, Brunswick, Germany. App. filed April 29, 1920. The regulation and control of dynamo-electric machines; a controlling system comprising a machine to be controlled, a main controlling circuit therefor, a sensitive circuit traversed by current impulses which control the action of the main circuit, and means associated with the sensitive circuit for shifting the phase of the impulses therein to vary the effect of the sensitive circuit upon the main controlling circuit.

1,603,154. MULTIPLE FUSE WITH ROTARY SWITCH; J. M. Schmierer, Berlin, Germany. App. filed Dec. 22, 1922.

1,603,165. HEAT-TREATING FURNACE; H. O. Swoboda, Edgewood, Pa., and E. M. Richards, Pittsburgh, Pa. App. filed April 28, 1925. Wherein the material to be treated is heated during its passage through one or more tubes or the like.

1,603,171. TROUBLE LAMP; C. Wade, Ionia, Mich. App. filed May 17, 1924. For automobiles in which magnetic coils are employed and in which the ignition current of the machine is employed for illuminating the lamp and energizing the coils so that the lamp can be supported and firmly held on any of the metal parts of the automobile.

1,603,194. TIME-CONTROL SWITCH; W. A. J. Corlin, Astoria, N. Y. App. filed Dec. 12, 1925. Means for attachment to an alarm clock for actuating a push-button electric switch for lighting a lamp or closing a circuit at the same time that the alarm is sounded.

1,603,208. ELECTRIC FLATIRON; W. H. Keiter, Toledo, Ohio. App. filed Oct. 25, 1922. For automatically cutting in and cutting out the heating element.

1,603,230. HIGH-FREQUENCY ALTERNATOR; P. M. J. Boucherot, Paris, France. App. filed Aug. 29, 1921. In a homopolar alternator for generating high-frequency currents, a rotor and a stator and means co-operating therewith for producing eddy currents when displacements occur between said parts due to vibrations of any origin.

1,603,244. FEEDING MECHANISM FOR ARC LIGHTS; P. Mole, Jr., Schenectady, N. Y. App. filed Oct. 7, 1922. A constant and continuous feed mechanism; to provide as an auxiliary feed the star automatic feed and to provide as a second auxiliary a hand feed.

1,603,255. MEANS FOR ATTACHING FIXTURES TO OUTLETS; H. Hubbell, Bridgeport, Conn. App. filed April 9, 1921. The combination with a fixture and a receptacle of means for electrically connecting the fixture with respect to the receptacle, and mechanically connecting and supporting the fixture with respect to the receptacle, said means comprising a supporting plate, a connection bracket and a plug-pin device having contacts for engaging the contacts of a receptacle, mounted for bodily sliding movement of the bracket, said bracket and plate being provided with interengaging means whereby said bracket may be connected to said plate by movement toward the receptable and laterally with respect thereto, and means for holding the bracket in connected position, comprising spring means positively preventing sliding movement of said bracket with respect to said plug-pin device.

(Issued Oct. 26, 1926)

1,604,111. ELECTRIC CONNECTOR; R. V. Bingay, Pittsburgh, Pa. App. filed Oct. 27, 1919. For busbar or heavy-current leads and particularly such leads as those of transformers, where the current is passed through the transformer casing, the inner lower ends of such leads being connected to wires from the coils and the upper outer ends to the supply or distribution circuits. The insulator in a plastic state is pressed and molded into the proper shape and then hardened to hold the bars in place in the bushing.

1,604,119. THEFT-PROOF LAMP; P. S. Haselton, Bayside, N. Y. App. filed Aug. 27, 1925. May be readily removed from a receptacle after the lamp is worn out and the bulb is broken.

1,604,134. MOVING-PICTURE LAMP; H. C. Rentschler, Pittsburgh, Pa. App. filed Feb. 14, 1921. Incandescent lamp adapted for use in concentrating light upon an object, as in motion-picture projectors, searchlights and the like.

1,604,162. TROLLEY; A. L. Henry and G. S. Moore, Indianapolis, Ind. App. filed Nov. 7, 1924. Having a shoe mounted to float on a pivot on the trolley pole and being so formed that it will maintain the same balanced relation on the pole at all times regardless of the extent of abrasion of the shoe by the friction of the wire.

1,604,163. MEANS FOR REGULATING MOTORS; J. Herman, New York, N. Y. App. filed Sept. 5, 1923. An automatic arrangement for governing the speed of a direct-current motor. An automatic arrangement for maintaining constant the frequency generated by an alternating-current generator, whether the generator be of the single-frequency or multi-frequency type. Means for controlling the speed of rotation of a motor-generator set, the control being exercised through changes in the frequency generated by the set as distinguished from a control depending upon changes in potential or current.

1,604,180, 1,604,181. ARC WELDING; J. F. Lincoln, Cleveland, Ohio. Apps. filed April 4, 1921, and Feb. 23, 1923. Whereby a continuous butt weld may be formed between the meeting edges of sheets of relatively light gage.

1,604,191. EXTENALLY OPERATED FUSE AND CUT-OUT MECHANISM; G. E. Palmer, Brookline, and E. G. Johnson, Boston, Mass. App. filed Feb. 21, 1923. Of the meter-service type.

1,604,203. ELECTRICAL CONTACT STRUCTURE; C. S. Snavely and Max Funcke, Pittsburgh, Pa. For electrical relays such as railway signaling relays.

1,604,209. SIGNALING DEVICE; J. M. Wenzel, Chicago, Ill. App. filed July 19, 1924. Electrically operated door releasers for apartment houses.

1,604,210. BATTERY INDICATOR; F. J. West, Winnipeg, Manitoba, Canada. App. filed Jan. 8, 1923. Which will visibly show the height of the electrolyte within the battery.

1,604,263. BATTERY-CHARGING SYSTEM; E. Dickey and H. P. Braeutigam, Dayton, Ohio. App. filed April 17, 1922. In which an internal-combustion engine drives a dynamo as a generator to charge a storage battery, from which current may be taken to operate the dynamo as a motor to crank the engine, and in which current is used to furnish electrical ignition for the engine. Means for controlling the ignition relay so as to render the same inoperative which it is desired to overcharge the battery.

1,604,282. SUBMARINE CABLE; R. A. Haislip, Montclair, N. J. App. filed March 28, 1921. The method of plugging a submarine cable having an outer protective sheath of uniform diameter to prevent the flow of water from a broken section into the adjacent sections. It comprises impregnating a section of the cable core in a sealing compound, binding the same section of core with elastic tape so as to force out the excess compound and reduce the diameter to a value smaller than that of the adjacent portions of the core, and subsequently binding the said section of core to build up its diameter to fit the cable sheath.

1,604,323. MAGNETIC HOLDING DEVICE; H. K. Spencer, Watertown, Mass. App. filed May 16, 1921. Magnetic chucks. Means for enabling the articles to be placed on the work support, carried toward the point where the work is to be performed, magnetically held when they reach a predetermined point in the travel of the work support, and released after the work has been performed, thereby enabling the work to be carried on continuously without the necessity of stopping the work support to reload the same from time to time.

1,604,334. CABLE INSULATION; R. W. Atkinson, Perth Amboy, N. J. App. filed May 12, 1923. An electrical cable including a conductor and a surrounding envelope of helically wrapped tape, the tape envelope being made up of superposed layers and the tape within each layer being laid in uniformly directed spirals and the tape of successive layers being laid in oppositely directed spirals, the last tape of an inferior layer and the first tape of a superior layer being less in thickness than the tapes beneath and above.